

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY SERIES 361

WASHINGTON, D.C. 20460

OFFICE OF

PREVENTION, PESTICIDES AND TOXIC SUBSTANCES

March 6, 2006

<u>MEMORANDUM</u>

Subject

Study Review: Determination of Dermal and Inhalation Exposure to

Reentry Workers During Maintenance Activities in Golf Courses"

(MRID# 467340-01), DP Barcode 327361.

From:

Seyed Tadayon, Chemist

Reregistration Branch 3 (7509C)

Health Effects Division

Through:

Danette Drew, Branch Senior Scientist

Reregistration Branch 3 (7509C)

Health Effects Division

To:

Seyed Tadayon, Chemist

Reregistration Branch 3 (7509C)

Health Effects Division

Attached is a review of the study entitled *Determination of Dermal and Inhalation Exposure to Reentry Workers During Maintenance Activities in Golf Courses*" (MRID# 467340-01t A primary review of the study was performed by Versar, Inc. under the supervision of HED. It has undergone secondary review in HED and has been revised to reflect Agency policies.

EXECUTIVE SUMMARY:

The purpose of this study was to estimate potential dermal and inhalation exposures and calculate dermal transfer coefficients among golf course workers re-entering a treated golf course to perform various golf course maintenance tasks. The tasks monitored included cup changing, greens mowing, greens watering, fairway mowing, irrigation repair, and miscellaneous grooming. Two trials were conducted at an 18-hole golf course near Hood River. The first trial was conducted on the first 9 holes and the second trial was conducted on the back nine holes. In both trials, each greenway or fairway section was treated once with Daconil Weather Stik® Flowable Fungicide Turf Care® Turf and Ornamental Fungicide containing the active ingredient (ai) chlorothalonil. The soluble concentrate product was applied using commercial ground boom sprayers at a rate of approximately 5.5 lb ai/A. The application for the second trial took place two days after the application for the first trial. Exposures were monitored for each activity on one and two days after application. The potential dermal exposures were assessed by using wholebody dosimetry (inner and outer), hand washes, and face/neck wipes. The potential inhalation exposures were assessed by using personal air sampling pumps attached to OVS tubes. A total of three to four replicates per re-entry interval (trials 1 and 2 combined) were collected. For each replicate, the work period was approximately 1.5 to 4.5 hours long.

Transfer coefficients for potential and total dermal exposure were calculated by the study author and Versar. These transfer coefficients are referred to as "index" transfer coefficients by the study author because they reflect exposure to a golf course that was mowed and partially irrigated during the study relative to concurrent turf transfer residue (TTR) measurements from undisturbed turf. The TTR samples were collected at 30-minute intervals for the entire period during which exposure monitoring was performed. TTRs were collected from separate, undisturbed treated plots for both simulated fairway and greens turf. Worker-specific TTR values were then determined from the individual TTR measurements that corresponded to the turf type involved in each worker's task and to the portion of the day during which the worker was monitored.

Versar corrected all of the raw residue values using the mean field fortification recovery of the closest field fortification level from each of the corresponding re-entry days for each matrix. Dermal transfer coefficients in cm²/hr were calculated by dividing the corrected residue value (µg) by the replicate duration (hr) and by the worker-specific turf transferable residue value (µg/cm²). Versar calculated total dermal transfer coefficients for three clothing scenarios: (1) wearing long pants and a long sleeved shirt, (2) wearing long pants and a t-shirt, and (3) wearing shorts and a t-shirt. For each clothing scenario, Versar summarized the transfer coefficients by re-entry day (separately and combined) and by maintenance task (separately and combined). Therefore, a total of 63 scenarios were evaluated by Versar (3 clothing combinations * 7 task combinations * 3 re-entry combinations). The maintenance tasks were combined because many of the tasks may be performed by most of the workers.

The total dermal exposure transfer coefficient for a worker wearing a long sleeved shirt and long pants is the sum of the inner dosimeter transfer coefficients for each body part, the hand wash transfer coefficient, and the face/neck wipe transfer coefficient. On reentry day 1, the geometric mean values for the various individual activities ranged from 289 cm²/hr (cup changing) to 1,583 cm²/hr (miscellaneous grooming) and the geometric mean value for the combination of the tasks was 680 cm²/hr. On re-entry day 2, the geometric mean values for the various individual activities ranged from 258 cm²/hr (greens mowing) to 3,006 cm²/hr (irrigation repair) and the geometric mean value for the combination of the tasks was 845 cm²/hr. For the combination of the re-entry days, the geometric mean values for the various individual activities ranged from 285 cm²/hr (greens mowing) to 1,771 cm²/hr (irrigation repair) and the geometric mean value for the combination of the tasks was 758 cm²/hr.

The total dermal exposure transfer coefficient for a worker wearing long pants and a t-shirt is the sum of the inner dosimeter transfer coefficients for each body part, the outer-dosimeter lower arms, the hand wash transfer coefficient, and the face/neck wipe transfer coefficient. On re-entry day 1, the geometric mean values for the various individual activities ranged from 409 cm²/hr (greens mowing) to 2,116 cm²/hr (miscellaneous grooming) and the geometric mean value for the combination of the tasks was 1,027 cm²/hr. On re-entry day 2, the geometric mean values for the various individual activities ranged from 609 cm²/hr (greens mowing) to 4,525 cm²/hr (irrigation repair) and the geometric mean value for the combination of the tasks was 1,794 cm²/hr. For the combination of the re-entry days, the geometric mean values for the various individual activities ranged from 499 cm²/hr (greens mowing) to 2,706 cm²/hr (irrigation repair) and the geometric mean value for the combination of the tasks was 1,358 cm²/hr.

The total dermal exposure transfer coefficient for a worker wearing short pants and a t-shirt is the sum of the inner dosimeter transfer coefficients for each body part, the outer-dosimeter lower arms and lower legs, the hand wash transfer coefficient, and the face/neck wipe transfer coefficient. On re-entry day 1, the geometric mean values for the various individual activities ranged from 1,489 cm²/hr (cup changing) to 5,459 cm²/hr (miscellaneous grooming) and the geometric mean value for the combination of the tasks was 2,998 cm²/hr. On re-entry day 2, the geometric mean values for the various individual activities ranged from 3,260 cm²/hr (fairway mowing) to 16,076 cm²/hr (irrigation repair) and the geometric mean value for the combination of the tasks was 6,966 cm²/hr. For the combination of the re-entry days, the geometric mean values for the various individual activities ranged from 2,609 cm²/hr (fairway mowing) to 9,254 cm²/hr (irrigation repair) and the geometric mean value for the combination of the tasks was 4,569 cm²/hr.

Versar calculated the inhalation exposure in $\mu g/hour$ for each maintenance activity and all activities combined. Versar used the NAFTA light activity breathing rate (16.7 L/min) to calculate the air concentration in $\mu g/m^3$ and the inhalation exposure in $\mu g/hour$. Residues were only detected at a level above the LOQ in one changing cup replicate, two irrigation repair replicates, and two miscellaneous grooming replicates. For residues less than the LOQ (0.01 μg), a value of ½ LOQ (0.005 μg) was used in all calculations. No residues

required correction for field fortification recoveries because all recoveries were >90%. On re-entry day 1, the average inhalation exposure values for the various individual activities ranged from 0.014 µg/hr (fairway mowing) to 0.140 µg/hr (cup changing) and the average inhalation exposure value for the combination of the tasks was 0.046 µg/hr. On re-entry day 2, the average inhalation exposure values for the various individual activities ranged from 0.013 µg/hr (irrigation repair) to 0.113 µg/hr (miscellaneous grooming) and the average inhalation exposure value for the combination of the tasks was 0.030 µg/hr. For the combination of the re-entry days, the average inhalation exposure value for the various individual activities ranged from 0.015 µg/hr (fairway mowing) to 0.090 µg/hr (miscellaneous grooming) and the average inhalation exposure value for the combination of the tasks was 0.037 µg/hr.

Versar summarized the distribution of residue on body parts for all three total dermal exposure clothing scenarios for the combination of all tasks. For the combination of reentry days, the residues with significant percentages (i.e., >10%) were found on the hands (60%), lower leg (16%), and lower arm (14%) for the long pants/long-sleeve shirt scenario, the hands (32%) and lower arms (53%) for the long pants/t-shirt scenario, and the lower legs (79.0%) and lower arms (12%) for the short pants/t-shirt scenario.

Although the purpose of this study was to calculate transfer coefficients, the data were generated from studies designed to fulfill the requirements of Series 875 Occupational and Residential Exposure Test Guidelines. The data presented in this study met the majority of the pertinent guidelines. The issues of concern are:

- The transfer coefficients exhibited a high degree of variability within each task monitored. As a result, the standard deviations calculated for many tasks were greater than the average residue value (68% of the scenarios evaluated by Versar). The reason for the variability was not reported. It appears that the transfer coefficients for the second trial (Study Days 3 and 4) were generally higher than the corresponding transfer coefficients from the first trial (Study Days 1 and 2). It also appears that the worker-specific TTR values from the second trial were generally lower than the TTR values from the first trial. For a few tasks, a high standard deviation can be attributed to a replicate with an extremely large or small residue value within the data set. These values were not discarded because there was no experimental basis for exclusion.
- (2) Many of the field residues were outside of the field fortification range. Typically, the residues were less than the lowest fortification level (up to 160 times less).
- (3) Only one location were used in this study (Oregon).
- (4) Irrigation data was not provided for the duration of the field study.
- (5) A rainfall event occurred on the morning of Study Day 3 (Second Trial, 1 Day after Application) prior to the monitoring period. Additionally, a light drizzle was apparent for 20 minutes in the afternoon on this monitoring day.

- (6) The guidelines recommend a minimum of 15 replicates per activity (5 replicates on 3 monitoring periods). In this study, a total of 6 to 8 replicates were collected at each re-entry time (1 and 2 days after application), with 3 to 4 total replicates per activity (re-entry days combined).
- (7) The protocol target application rate was set at 5.5 lb ai/acre; however, the maximum label recommended application rate for a single application was 11.3 lbs ai/A.
- (8) Breakthrough testing and a retention study of particulate levels and vapor phase levels on the air fiberglass filters were either not performed or not reported in the Study Report.
- (9) Data from a 9-month storage stability test that was conducted previously were not provided in the Study Report; however, field fortification and travel recoveries indicated acceptable storage stability.
- (10) The upper arm, front & rear torso, and upper leg portions of the outer dosimeters were not analyzed. (11) There was uncertainty in the estimates of total acreage for greens and fairways areas treated.

COMPLIANCE: Signed and dated GLP, Quality Assurance, and Data Confidentiality statements were provided. The study sponsor waived

claims of confidentiality within the scope of FIFRA Section 10(d) (1) (A), (B), or (C). The study sponsor and author stated that the study was conducted under EPA Good Laboratory Practice Standards (40 CFR part 160) with the following exceptions: (1) the balance used to weigh workers was not maintained (e.g., no calibrations) according to GLPs; (2) the uniformity and concentration of the test substance when mixed with the carrier (tank mix) was not determined; and (3) the golf course survey conducted using a handheld GPS device was not conducted under GLPs. None of these deviations were thought to have compromised the scientific integrity of this study according to the study author.

CONCURRENT TRANSFERABLE TURF RESIDUE STUDY?:

Yes

A separate TTR study review will be prepared per EPA instructions.

GUIDELINE OR PROTOCOL FOLLOWED: The study protocol submitted to EPA was dated August 25, 2004. OPPTS Series 875, Occupational and Residential Exposure Test Guidelines, Group B: 875.2400 (dermal exposure), and 875.2500 (inhalation

exposure) were followed for the compliance review of this study.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test Material:

Daconil Weather Stik® Flowable Fungicide Turf Care® Turf

and Ornamental Fungicide - a liquid flowable formulation

containing 54.0 percent active ingredient (chlorothalonil).

Batch #:

Formulation:

FL041051 (formulated product)

Lot #:

S02-2673 (reference standard)

Purity:

The purity of the reference standard was verified at 99.5% with

an expiration date of September, 2008.

CAS #(s):

1897-45-6

Other Relevant Information: EPA Reg. No. 50534-209-100. The test product was

packaged in 2.5-gallon plastic jugs.

2. Relevance of Test Material to Proposed Formulation(s):

The liquid flowable formulation sent to the field site was labeled as Daconil Weather Stik® Flowable Fungicide Turf Care® Turf and Ornamental Fungicide, which is the same product discussed in the assessment. A label for this product was not provided with the Study Report, however, a label was obtained through EPA's PPLS. The test product used for this study has the same product name and formulation that appears on the test product label.

B. STUDY DESIGN

There was one amendment to and five deviations from the study protocol. The amendment to the protocol defined the analytical phase for the analysis of the field samples. The deviations from the protocol were as follows: (1) TTR sampling frames could only be secured with spikes at the two front corners; (2) four workers did not have prior experience doing irrigation repair, but they were trained prior to the initiation of the study; (3) the mowing schedule was changed because there was not enough time to complete mowing on Study Day 2; (4) the approach for estimating the treatment rate was changed due to uncertainty in the estimates of total acreage for greens and fairway areas; and (5) on three of the four monitoring days, some of the field fortification solutions used were intended for different study days. The amendment and five deviations were reported not to have any adverse effects on the study's overall integrity.

1. Site Description

Test locations:

This study was performed on a public, 18 hole golf course near Hood River, Oregon, which is located about 60 miles east of Portland, Oregon.

Areas sprayed and re-entered: All 18 holes of the course (fairways and greens) were treated and used for maintenance worker exposure monitoring. In addition, two practice greens and two fairway turf practice areas were treated and used exclusively for TTR sampling. Half of the greens and half of the fairways (front nine holes) were treated on October 3, 2004 and the second half of the greens and second half of the fairways (back nine holes) were treated on October 5, 2004.

The front nine holes (holes 1 through 9) encompassed approximately 40 acres of turf area and the back nine holes (holes 10 to 18) encompassed approximately 30 total acres of turf area. The front nine holes are slightly longer and flatter than the back nine holes, which are hilly and have some narrow fairways. The greens average approximately 4,000 square feet each (approximately 0.09 acres, equivalent to roughly a 70-foot diameter circle). The test site layout is shown in Figure 4 of the Field Report.

There was uncertainty in the estimates of total acreage for greens and fairway areas treated.

Meteorological Data:

A weather station was placed near the dressing/undressing tent, which continuously monitored wind speed and direction, temperature, and relative humidity on the application and reentry days. Data were recorded every 60-minutes. Rainfall was monitored at the site for the duration of the study using a plastic rain gauge. Irrigation data were not provided in the Study Report. A total rainfall of 0.15 inch occurred the morning after the second application (0400 to 0700). The rain stopped prior to the first monitoring event. Additionally, a very light drizzle was observed in the afternoon on this monitoring day. Table 1 provides a summary of the weather conditions during the application or monitoring event based on hourly summary data.

Table 1. Sumn	nary of Meteo	rological N	Measureme	ents Collected	During Stu	dy ¹
Parameter	1 st Application	Re-entry Day 1	Re-entry Day 2	2 nd Application	Re-entry Day 3	Re-entry Day 4
Date	10/3/04	10/4/04	10/5/04	10/5/04	10/6/04	10/7/04
Min. Temp (°C)	15.7	6.5	8.3	18.8	13.6	7.4
Max. Temp (°C)	26.7	26.0	23.9	23.9	20.9	21.6
Min RH (%)	20.1	21.4	36.6	33.3	54.9	38.5
Max RH (%)	52.3	84.0	78.0	46.8	91.9	88.5
Min Wind Speed (avg. mph)	0.0	0.0	0.31	4.21	0.0	0.68
Max Wind Speed (avg. mph)	1.66	0.82	6.76	6.76	5.92	2.59
Wind Direction (avg, compass degrees)	30 – 71	56 – 82	97 – 288	266 – 270	200 – 272	16 – 320
Min Soil Temp. (°C)	18.8	12.6	13.0	17.3	15.5	13.3
Max Soil Temp (°C)	28.6	21.1	19.7	19.4	19.6	20.5
Rainfall	None	None	None	None	Trace	None
Moisture Conditions	NA	Dew, until 1000 to 1200	Dew, until 0900 to 1030	NA	Ground wet from rain; very light drizzle for about 20 minutes in aftermoon	Dew, until 100 to 1200
Other rainfall		0.15 inch	on 10/6/04	between 0400 :		L

All data were collected on site. Weather conditions are during the application or monitoring event and are based on hourly summary data.

2. Crop Characteristics

Crop, variety:

The fairways were comprised of *Poa annua* turf and the greens were comprised of a mix of bent grass and (mostly) *Poa annua* turf.

Row width, plant spacing:

Not Applicable.

Stage of growth:

Prior to the initiation of the study, the fairways were mowed to a height of ¾-inch and the greens were mowed to a height of 7/32-inch. Some areas of the course, such as the tee boxes and areas around the greens (collars and aprons), were moved to a height of ½-inch.

Other products used on crop: There were no maintenance pesticides used on the golf

course since March 2004, except for one application of the test product on the front nine holes. This application was made on September 12, 2004 at a target application rate of 6 lb ai/A. The study was expected to begin on that day, but the study was postponed due to significant rain events on September 13 and 14, 2004.

Granular fertilizer (N-P-K = 10-6-4; 10% Nitrogen, 6% Phosphorus, and 4% Potassium) was applied to all 18 greens plus the 2 practice greens over a two-day period of September 16 to 17, 2004. Prior to that there were no fertilizer treatments on the golf course since approximately March 2004.

3. Application Rates and Regimes

Application rate(s):

The protocol and field phase of the Study Report stated that the target application rate was 5.5 lbs ai/A. This less-thanmaximum application rate was selected to better represent the application rate of typical golf course turf products. The maximum label recommended application rate for a single application is 15.1 pints/A (11.3 lbs ai/A). The actual application rates for the first day of applications (10/3/04) were 5.45 lbs ai/A for the fairways and 5.50 lbs ai/A for the greens. The actual application rates for the second day of applications (10/5/04) were 5.30 lbs ai/A for the fairways and 5.55 lbs ai/A for the greens. The actual application rates were determined by timed passes of each sprayer over the treated TTR areas and the measured total spray nozzle outputs. It was decided that this approach was more accurate than the procedure specified in the protocol due to the uncertainty in the estimates of total acreage for greens and fairways treated.

Application Regime:

One application of Daconil Weather Stik® Flowable Fungicide Turf Care® Turf and Ornamental Fungicide was made on each section of greenway and fairway, which preceded two days of

reentry. Half of the greens and half of the fairways (holes 1 through 9) were treated on October 3, 2004, and the second half of the greens and second half of the fairways (holes 10 through 18) were treated on October 5, 2004.

Application Equipment:

The golf course fairways and greens were sprayed with two tractor-mounted groundboom broadcast spray rigs. On each application day, the greens were sprayed using a sprayer fitted with a 110-gallon tank and a 3-section drop nozzle boom attachment that sprayed a 15-foot swath of turf. The sprayer was a Cushman Truckster Model 8020 sprayer fitted with nine flat fan spray nozzles with 50-mesh screens at 20-inch spacing. The fairways were sprayed in part with the Cushman sprayer and in part with a John Deere 1500 Turf Sprayer fitted with a 150-gallon tank and a shielded drop nozzle boom attachment that also sprayed a 15-foot swath of turf. The sprayer was fitted with nine flat fan spray nozzles with 50-mesh screens at 20-inch spacing.

Spray Volume:

The greens were sprayed with a volume of approximately 82 to 84 gallons per acre (GPA) and the fairways with a volume of approximately 28 to 29 GPA. The label recommended application volume ranges from 90 to 450 GPA for greens and 30 to 40 GPA for fairways.

Equipment Calibration

Procedures:

According to the study protocol, the spray equipment was to be calibrated prior to each application using field facility SOPs. Details of the calibration procedure were not provided.

4. Number and type of workers:

Nine male workers participated in the study on two to four of the reentry days. They ranged in age from 21 to 50 years and their amount of experience with golf course maintenance tasks ranged from less than 1 year to 25 years. The workers with less than a year previous experience were trained prior to the initiation of the study by experienced workers. Each worker signed an informed consent form, which explained the purpose of the study, the procedures, and a statement of their rights.

5. Protective clothing:

All workers wore 100% cotton long underwear (inner dosimeter) over their choice of undergarments. Long-sleeved 100% cotton shirts and long pants (outer dosimeter) were worn over the inner dosimeter. Each worker wore closed-toe shoes or boots

(mostly tennis or jogging style shoes) and a new pair of crew socks. The golf course workers did not wear gloves during the maintenance activities.

6. Time Interval(s) for Re-entry:

There were two re-entry intervals: 1 day after treatment (1 DAT) and 2 days after treatment (2 DAT). Tasks were monitored on one day after application on study days 1 and 3 and two days after application on study days 2 and 4. Study days 1 (1 DAT) and 2 (2 DAT) were monitored using the first half of the greens and fairways and Study days 3 (1 DAT) and 4 (2 DAT) were monitored using the second half of the greens and fairways.

7. Replicates:

The re-entry activities evaluated in this study were associated with golf course maintenance. The workers performed various assigned tasks for exposure monitoring periods of generally two to four hours. In order to obtain six to eight monitoring replicates of each monitoring task, some workers performed more than one task on some or all reentry days. The golf course maintenance tasks included: changing cups (replicates CC1 - CC6), mowing greens (replicates GM1 – GM8), watering greens (replicates GW1 – GW8), mowing fairways (replicates FM1 – FM8), repairing irrigation (replicates IR1 – IR8) and performing miscellaneous grooming (replicates MG1 – MG6). Overall, nine male workers participated and a total of 44 worker monitoring replicates were obtained. A total of 3 to 4 replicates per activity were monitored for each re-entry interval (6 to 8 replicates for combined re-entry days).

Exposure monitoring took place on four consecutive days, with 11 monitoring replicates per day. In general, the monitoring tasks began at approximately 0700 with cool temperatures and wet turf (from dew or rain) and ended by about 1730 with warm temperatures.

A description of each activity is provided below.

Changing Cups: A hand operated cup cutter was used to make a new hole and the plastic cup liner from the old hole was put into the new hole; the old hole was then filled with sand and the plug from the new hole. Some cup changers also repaired ball marks on the greens with a hand tool similar to those used by golfers. Cup changing occurred first thing in the morning and a monitoring replicate consisted of changing 18 cups (each of 9 holes two times). This task took approximately 1.5 to 2.5 hours, including 33 to 110 minutes changing the cups, 43 to 52 minutes traveling between holes, and 0 to 20 minutes spent resting, talking to other workers, or performing tasks other than cup changing.

Most workers performed the cup changing while bending over and not contacting the turf with anything, but their shoes and hands; however, one worker (CC1) routinely kneeled on one knee and two other workers (CC2, CC3, and CC6) kneeled for a few holes. Only one of the replicates (CC3) performed significant ball mark repair (79 instances). The rest performed 0 to 1 ball mark repairs.

Mowing Greens: A walk-behind reel mower with a grass catcher was used to make two passes (perpendicular) to cut the green to 7/32-inch height. Mowing included emptying the grass catcher by spreading clippings in the rough areas around the golf course. The worker also hosed off the mower with water at the conclusion of mowing. Greens mowing occurred in the morning (after cups had been changed) and a monitoring replicate consisted of mowing 4 to 5 greens. This task took approximately 2 to 3 hours, including 89 to 140 minutes mowing or emptying baskets, 23 to 43 minutes traveling between holes, and 0 to 29 minutes spent resting, talking to other workers, or performing tasks other than mowing.

When the mower was engaged, the workers walked briskly behind the mower to keep up. At the end of each pass, the worker pushed down on the mower handle to the lift the reel off the ground and quickly turned the mower around to make the next pass adjacent to the previous pass. Workers generally mowed in one direction, then the other, and then made a pass around the perimeter of the green to finish off the mowing process.

Watering Greens: A hose and spray nozzle was used to evenly saturate each green in its entirety. Greens watering occurred in the afternoons and a monitoring replicate consisted of watering 4 to 5 holes. This task took approximately 2 to 3 hours, including 95 to 143 minutes handling hoses or watering, 9 to 24 minutes traveling between holes, and 0 to 61 minutes spent resting, talking to other workers, or finding no water pressure and not watering.

For three of the replicates, the hose was attached to a metal water valve key that goes into a greenside water valve. For five of the replicates, the hose was screwed into a water bib on a gasoline powered pump that delivered water from a portable water tank. Workers for these five replicates connected and disconnected their hose to the hose bib on the pump outlet, but did not operate the pump or move the water tanks (this was done by a researcher).

Mowing Fairways: Either a 5-reel riding mower was used to mow actual fairways to 34-inch height or a 3-reel riding mower was used to mow tee boxes and surrounds (areas around the greens) to ½-inch height. Both mower types had grass catchers and mowing included emptying the grass catchers by spreading clippings in the rough areas around the golf course. The worker also hosed off the mower with water at the conclusion of mowing. Fairway mowing occurred in the morning and a monitoring replicate consisted of mowing either 5 to 6 fairways or surrounds for 9 holes. This task took approximately 2 to 4.5 hours, including 96 to 253 minutes mowing fairway or surrounds, 11 to 30 minutes traveling, and 0 to 4 minutes talking to other workers or repairing motor.

The workers generally mowed the fairways and surrounds in one of two patterns: 1) mow the perimeter, then back-and-forth or 2) in a "spiral" pattern, from the outside to inside. The mowers were operated at a low speed (3.5 miles per hour) since it was found that moist grass clippings were not efficiently "thrown" into the grass catchers if the speed was higher. When the grass was wet, the 5-reel mower would frequently get clumps of turf caught in the reel mechanisms, which would require the operator to lift the reels, stop the mower, get off, and clear the clipping from the reels with his hands and/or a stick. The workers would also occasionally dismount to remove debris or to move 150-yard markers.

Miscellaneous Grooming: The most common activities were cutting weeds and grass with a gas-powered string trimmer; trimming trees/shrubs with hand-held pruners; hand weeding and raking bunkers; and moving tee markers. Other tasks included leaf blowing, raking debris on the course (and picking up by hand), digging rocks out of fairways (with shovel, pick, and pry bar), leveling gopher mounds (with feet, rake, or shovel), and spray painting distance markers in the fairways. Grooming occurred in the morning or afternoon. This task took approximately 3 to 3.5 hours, including 98 to 200 minutes working, 17 to 42 minutes traveling between repairs, and 0 to 48 minutes spent resting or making an extra trip to the maintenance shed for tools.

Irrigation Repair: The turf was dug up and the sprinkler heads were lifted up to the appropriate height. The hole was then filled with soil to support the sprinkler head and the turf was then replaced. Irrigation repair occurred in the morning or afternoon. This task took approximately 3 to 3.5 hours, including 129 to 184 minutes performing irrigation repairs and making trips to the sand pile for more sand, 17 to 44 minutes traveling between repairs, and 0 to 10 minutes spent resting or talking to other workers.

Irrigation repair was a rigorous activity and workers on warm afternoons would perspire significantly. The activity involves steps where contact between the worker and the turf is intense and prolonged. In addition, several workers became quite dirty during the process.

8. Exposure monitoring methodology:

Dermal: Potential dermal exposure was monitored using both outer and inner whole-body dosimeters, hand washes, and facial (face and neck) swabs. The workers were provided multiple sets of latex gloves and were assisted by study personnel while removing each item of clothing to minimize cross contamination. These gloves were discarded after each article was removed.

Outer Dosimeters - The outer dosimeters consisted of a 100% cotton, white, long-sleeved shirt and long pants. These outer dosimeters were worn directly over the inner dosimeters with the shirttail tucked in. At the end of each monitoring period, the outer dosimeters were carefully removed. The dosimeters were cut into the following three sections using scissors that were solvent-cleaned between replicates: (1) left/right lower arms combined (elbows to cuffs); (2) left/right lower legs combined (knees to cuffs); and (3) remainder (upper arms, torso, and upper legs). Each section was wrapped in foil, sealed in a labeled bag, and placed into an on-site freezer for temporary storage within four hours of collection.

Inner Dosimeters - The inner dosimeters consisted of a one-piece, white, long underwear suit constructed of 100% cotton provided by the ARTF. They were worn directly under the outer dosimeters. At the end of each monitoring period, the inner dosimeters were carefully removed after the outer dosimeters. The dosimeters were cut into the following six sections using scissors that were solvent-cleaned between replicates: (1) left/right upper arms combined (shoulder seam to elbow); (2) left/right lower arms combined (elbows to cuffs); (3) left/right upper legs combined (waist to knees); (4) left/right lower legs combined (knees to cuffs); (5) front torso (above the waist): and (6) rear torso (above the waist). Each section was wrapped in foil, sealed in a labeled bag, and placed into an on-site freezer for temporary storage generally within 4 hours of collection.

Face and Neck Wipes - Face and neck exposures were monitored by wiping the worker's face and neck (front and back) with a 100% cotton gauze pad (eight-ply, 4 inch by 4 inch) moistened with approximately 4 mL of 0.01% Aerosol® OT-75 aqueous solution in distilled water. Two pads were combined to produce one sample. Immediately before each monitoring period, each worker would wash his face and neck with a paper towel containing soap and water and then discard the paper towel. Face/neck wipes were performed immediately after hand washes were collected. A face/neck wipe sample was taken at the end of the exposure period and prior to any break that involved eating or using the restroom. Only one worker (GW2) required an interim face/neck wipe sample and the two samples were combined as a single face/neck wipe sample for analysis. Each sample was placed in a labeled glass jar capped with a Teflon®-lined lid and placed into frozen storage within four hours of collection.

<u>Handwash</u> - Immediately before each monitoring period, the worker washed his hands with a paper towel containing soap and water and then discarded the paper towel. None of the workers wore gloves to perform the turf maintenance activities. Hand exposure was assessed by hand washes collected from the workers at the end of the

exposure period and prior to any break that involved eating or using the restroom. Only one worker (GW2) required an interim hand wash sample and the two samples were submitted separately for analysis. Each handwash consisted of a field investigator pouring 250 mL of an anionic solution (0.01% v/v) of Aerosol® OT over each worker's hands as the worker scrubbed his hands over a stainless steel bowl for approximately 30 seconds. Handwash samples were poured from the bowl into a prelabeled glass jar and the process was repeated. The solutions were combined in the sample glass jar, capped with a Teflon®-lined lid, placed into a plastic re-sealable bag, and stored frozen within 4 hours of collection.

Inhalation: Potential inhalation exposure was monitored for each worker using OVS tubes with a glass fiber filter and Chromosorb-102 sorbent. Before each monitoring period, the pump flow rate was calibrated to an airflow rate of approximately 2 liters per minute. At the end of each monitoring period, the air flow rate was checked with the same flowmeter. The air sampling pumps operated continuously during the entire monitoring period. At the end of each replicate, the OVS tubes were disconnected from the tubing, the ends were capped, and the tubes were bagged, labeled, and placed into frozen storage within 4 hours of collection. For replicate FM5, the pump was not running at the end of the work period. It was turned on by researchers and the flow was checked as usual. The pump was last observed in operation 87 minutes before the end of the work period.

9. Analytical Methodology:

Extraction method(s): All of the field samples were kept frozen during transport to the analytical laboratory and remained frozen until analysis. The following is a brief description of the extraction procedures for each of the matrices.

<u>Dosimeters</u> - The inner and outer dosimeter samples were extracted with 2 liters of hexane by shaking for approximately 30 minutes and allowed to sit for a minimum of 8 hours at ambient temperature. A portion of the extract was removed and evaporated to near dryness. The samples were re-dissolved in ethyl acetate and analyzed by gas chromatography with electron capture detection (GC/ECD).

<u>Face/Neck Wipes</u> - The samples were transferred into 250-mL glass jars. 100 mL of ethyl acetate were added and the jar was shaken for 30 minutes. A portion of the extract was analyzed by GC/ECD.

<u>Hand Washes</u> – The sample was transferred into a 1,000 mL separatory funnel and a 10 mL portion of 20% NaCl, 2 mL of 10 N H₂SO₄, and 50 mL of 1:1 petroleum ether:diethyl ether were added. The separatory funnel was shaken for 2 minutes with venting and the

top ether phase was transferred to a 100 mL round bottom flask. The extraction was repeated with another 50 mL portion of 1:1 ether and this ether phase was added to the first. The reserved ether was concentrated to near dryness with a rotary evaporator and dissolved in ethyl acetate and analyzed by GC/ECD.

OVS Tubes - The contents of the OVS tubes were quantitatively transferred to a 20 mL scintillation vial. A 2.0 mL portion of ethyl acetate was added to the empty tube and was then allowed to drip into the same scintillation vial. Ethyl acetate was added to the vial so that the volume of solvent totaled 10 mL. The scintillation vial was shaken for 2 minutes and a portion of the solvent was removed and analyzed by GC/ECD.

Detection method(s): See Table 2.

Т	able 2. Summary of Chromatographic Conditions
GC Column:	HP 5890, RTX-5, 30 M X 0.53 mm, 0.5 μm film thickness
Temperatures:	Injector: 270 °C Detector: 350 °C Column: 160 °C for 1 min. Program Rate 1: 240 °C@ 20 °C/min, hold 2 min. Program Rate 2: 270 °C @ 20 °C/min, hold 6 min.
Carrier Gas:	Hydrogen
Makeup Gas:	Nitrogen
Gas Flow:	Hydrogen: 8 mL/minute Nitrogen: 30 mL/minute
Injection Volume:	1 μL

Method validation:

Five validated analytical methods were utilized for the determination of chlorothalonil in each of the matrices used in this study. The methods were validated by Ricerca Biosciences, LLC. Results for the method validation were not provided in the Study Report. The LOQ for the dosimeters, face/neck wipes, and handwashes was 1.0 µg. The LOQ for the OVS tubes was 0.01 µg.

Instrument performance and calibration:

on: Calibration standards were diluted from a 50.0 mg/mL primary stock solution in ethyl acetate received on August 19, 2004. GC standards were prepared from this stock solution by dilution with ethyl acetate. Chlorothalonil concentrations ranged from nominal 0.001 μg/mL to 10.0 μg/mL. The R² value (square of the correlation coefficient) for each set of standards was at least 0.99 and the results of back calculating the standards to those curves were generally within + 20% for the lowest standard in the set and + 10% for all other standards. At least four calibration standards were run with each set.

Quantification:

Chromatographic quantification was achieved using a standard curve obtained from peak heights or areas of injections of several concentrations of standards. The peak areas were converted to a µg amount using the best-fit line

created with the calibration standards in each run sequence.

10. Quality Control:

Laboratory Recovery:

Two concurrent laboratory fortification samples and one control sample (field or laboratory) were analyzed with each set of samples to evaluate the validity of the analytical data. The fortification concentrations ranged from 5 to 10,000 µg, depending on the matrix. Table 3 summarizes the ranges of the fortification concentrations for each matrix along with the percent recoveries. Average recoveries by fortification level and matrix ranged from 71 to 104%. For each matrix, the mean recovery fell within the acceptable range of 70% to 120%. The standard deviation was less than 20% for all, but the outer dosimeter high level and face/neck wipe low level fortifications. All lab control samples were less than the <LOQ, except for one inner dosimeter blank at 2.03 µg.

Table 3. Concur	rent Laborat	ory Fortificati	on Sample Rec	overy Summa	ry 🚉 📑
Matrix	Amount Fortified (µg)	Recovery Range (%)	Average Recovery (%)	Standard Deviation	(n)
	10	69.8 to 123	99.4	16.2	16
Outer Dosimeter	5,000	84.8 to 118	101	14.0	9
	10,000	72.7 to 147	100	29.5	5
	10	66.2 to 118	95.9	15.8	20
Inner Dosimeters	1,000	94.0	94.0	n/a	I
inner Dosiniciers	2,000	76.3	76.3	n/a	1
	5,000	69.3 to 120	94.3	16.1	17
	5	71.2 to 126	90.9	21.0	5
Face/Neck Wipe	10	70.9	70.9	n/a	1
	100	89.9 to 126	104	15.0	5
Hand Wash	5	73.7 to 114	97.4	14.8	6
	1000	89.3 to 129	109	n/a	: 2

Table 3. Concur	rent Laborat	ory Fortificati	on Sample Rec	covery Summa	ry 📆 -
Matrix	Fortified (μg)	Recovery Range (%)	Average Recovery (%)	Standard Deviation	(n)
	2000	74.4 to 104	82.8	14.0	4
OVS Tubes	10	97.5	97.5	n/a	1

Field blanks:

One control sample of each matrix was received on each of the four reentry days. All residues were less than the LOQ in these samples except for one hand wash sample, which contained $1.7~\mu g$ of chlorothalonil.

Field recovery:

Field fortification samples were prepared in triplicate at each of two or three spiking levels per matrix on each day of monitoring and analyzed to assess stability of chlorothalonil from the time of spiking, through aging in the field, freezing, shipping to the analytical laboratory, and analysis. The OVS tubes and inner and outer dosimeter sections were exposed to environmental conditions for approximately 4 to 4.5 hours, the maximum worker monitoring period. Hand wash and face/neck wipes were placed in frozen storage within a few minutes of fortification. Table 4 summarizes the range of field fortification concentrations used for each matrix and the average recoveries. The overall average recoveries by fortification level and matrix ranged from 71% to 112%. All mean recoveries were within the acceptable range of 70% to 120%. One low level OVS tube field fortified sample had a recovery of 12.0% indicating that it might not have been spiked.

Many of the field residues were outside the range of the fortification levels. Below is a summary of these occurances:

For the outer dosimeters (pants and shirts), the fortification range was from 500 to 10,000 μ g; however, 38% of the field samples had residues less than the lowest fortification level (3.1 to 499 μ g).

For the inner dosimeters, the fortification range was from 10 to 5,000 μ g; however, 43% of the field samples (not including those <LOQ) had residues less than the lowest fortification level (1.2 to 8.92 μ g). Additionally,

one sample had a residue value of 10,517 µg which exceeded the highest fortification level.

For the face/neck wipes, the fortification range was from 5 to 5,000 μ g; however, all field residues were either <LOQ or less than the lowest fortification level (1.05 to 3.33 μ g).

For hand washes, the fortification range was from 500 to 10,000 μ g; however, 93% of the field samples had residues less than the lowest fortification level (15 to 477 μ g).

For the OVS tubes, the fortification range was from 0.05 to $10 \,\mu g$. Of the five field samples with residues above the LOQ, two had residues, which were below the lowest fortification level $(0.025 \, \text{and} \, 0.038 \, \mu g)$.

1	able 4. Su	immary of l	Field Fort	ification Red	coveries	
Matrix	Study Day ¹	Fortificat ion Level	Amoun t Fortifie d (µg)	Average Recovery (%)	Overall Average Recovery (%)	Standa rd Deviati on
	Day 1	Low	500	78.9	81.5	9.62
	Dayı	High	10,000	84.2	61.5	7.02
	Day 2	Low	500	85.9	89.8	21.2
Outer Dosimeter	Day 2	High	10,000	93.6	09.0	21.2
(pants)	Day 3	Low	500	105	88.1	24.8
	Day 5	High	10,000	71.2	00.1	24.0
	Day 4	Low	500	89.0	90.7	15.4
	Day 4	High	10,000	92.4	90.7	13.4
	Day I	Low	500	79.3	79.3	9.24
	Dayı	High	10,000	79.3	19.3	9.24
	Day 2	Low	500	87.7	88.8	22.7
Outer Dosimeter	Day 2	High	10,000	89.8	00.0	22.1
(shirts)	Day 3	Low	500	96.1	86.5	12.7
	Day 3	High	10,000	76.9	00.5	12.7
	Day 4	Low	500	87.3	91.0	15.1
	Day 4	High	10,000	94.7	91.0	1.7.1
Inner Dosimeters		Low	10	80.5		
	Day 1	Medium	500	92.0	89.2	22.2
		High	5,000	95.3		
	Day 2	Low	10	114	92.0	19.3
		Medium	500	82.3		

	lable 4. Su	mmary of	Field Fort	ification Rec	overies 🕌 🗀	
Matrix	Study Day ¹	Fortificat ion b	Fortifie d	Average Recovery (%)	Overall Average Recovery (%)	Standa rd Deviati
			(µg)			on .
		High	5,000	79.5		
		Low	10	86.8		-
	Day 3	Medium	500	95.4	97.2	17.0
		High	5,000	109		
		Low	10	90.8		
	Day 4	Medium	500	89.8	92.6	14.6
		High	5,000	97.3		
	Day 1	Low	5	90.5	98.3	21.5
	Day 1	High	100	106	90.3	21.3
	D 3	Low	5	89.6	102	22.4
T /NT 1 NV:	Day 2	High	100	115	103	23.4
Face/Neck Wipes	D 2	Low	5	92.8	02.6	100
	Day 3	High	100	92.3	92.6	12.9
		Low	5	92.9	0.5.0	
	Day 4	High	100	99.7	96.3	11.8
	Day 1	Low	500	85.4		
		Medium	2,000	104	95.6	23.6
	,	High	10,000	97.8	1	
		Low	500	88.9		
	Day 2	Medium	2,000	98.6	89.5	19.9
		High	10,000	84.0		
Hand Wash ²		Low	500	71.0		ļ
	Day 3	Medium	2,000	86.4	85.4	18.3
		High	10,000	98.6		
		Low	500	92.6		-
	Day 4	Medium	2,000	94.2	96.1	13.9
		High	10,000	102	1	10.7
		Low	0.05	96.9	-	
	Day 1	High	10	116	107	21.4
		Low	0.05	92.0		
	Day 2	High	10	109	100	18.3
OVS Tubes ³		Low	0.05	112	 	
	Day 3	High	10	96.2	102	13.0
		Low	0.05	110	 	1
	Day 4	High	10	107	108	13.5
1 Study Day 1 - Reentry						<u> </u>

^{1.} Study Day 1 =: Reentry 1 Day After Single Application on First Half of Course (Trial #1)

Study Day 2 = Reentry 2 Days After Single Application on First Half of Course (Trial #1)

Study Day 3 = Reentry 1 Day After Single Application on Second Half of Course (Trial #2)

Study Day 4 = Reentry 2 Days After Single Application on Second Half of Course (Trial #2)

2. Handwash: Day 2 - 3rd mid-level sample was broken, no results for this sample.

3. OVS Tubes Day 3 - 1st low level sample does not appear to have been spiked. This result was dropped from the mean.

Formulation: The test product used in this study was a flowable liquid

containing a nominal 54% active ingredient (ai) chlorothalonil. According to the GLP analysis, the test product contained 53.4%

(w/w) active ingredient (Certificate of Analysis A12531B,

8/13/04). The Analytical Report stated that the analytical standard of chlorothalonil had a purity of 99.5% (expires September 2008).

Tank mix:

Not conducted

Travel Spikes:

Duplicate travel spikes were prepared at the highest fortification level for outer shirts, outer pants, inner dosimeters, and OVS tubes on each monitoring day. Average recoveries by matrix and study day ranged from 76% (outer dosimeter pants, Study Day 3) to

122% (outer dosimeter pants, Study Day 4).

Storage Stability:

According to the study author, frozen storage stability of chlorothalonil was demonstrated in previous studies for all matrices. These results were not provided in this Study Report. The longest interval between sample collection/frozen storage and thawing for analysis was approximately 9 months. The study author states that the results from this study indicate that chlorothalonil was generally stable under field conditions, during transit, and during storage, and no significant sample degradation occurred.

11. Relevancy of Study to Proposed Use:

The study design and the proposed uses for this chemical are similar.

II. RESULTS AND CALCULATIONS:

A. EXPOSURE CALCULATIONS:

Transfer coefficients for potential and total dermal exposure were calculated by the study author and Versar. These transfer coefficients are referred to as "index" transfer coefficients by the study author because they reflect exposure to a golf course that was mowed and partially irrigated during the study relative to concurrent turf transfer residue (TTR) measurements from undisturbed turf. The TTR samples were collected at 30-minute intervals for the entire period during which exposure monitoring was performed. TTRs were collected from separate, undisturbed treated plots for both simulated fairway

and greens turf. Worker-specific TTR values were then determined from the individual TTR measurements that corresponded to the turf type involved in each worker's task and to the portion of the day during which the worker was monitored.

The study author corrected all raw residue values using the mean recovery of the closest field fortification level from all four reentry days for each matrix. All raw residue values $\exists LOQ$ were corrected to 100% recovery. All raw residue values below the LOQ were not corrected for recovery, but were given a value of ½ LOQ as the final adjusted value for each matrix. Versar re-corrected all of the raw residue values using the mean field fortification recovery of the closest field fortification level from each of the corresponding re-entry days for each matrix. All raw residue values $\exists LOQ$ were corrected for average field fortification recoveries < 90%. All raw residues below the LOQ were given a value of ½ LOQ. Neither the registrant nor Versar conducted any statistical tests for outliers in this data set. All values were used unless the samples were compromised in the field, during transit, or during analysis.

Dermal transfer coefficients in cm²/hr were calculated by dividing the corrected residue value (µg) by the replicate duration (hr) and by the worker-specific turf transferable residue value (µg/cm²). Versar calculated total dermal transfer coefficients for three clothing scenarios: (1) wearing long pants and a long sleeved shirt, (2) wearing long pants and a t-shirt, and (3) wearing shorts and a t-shirt. For each clothing scenario, Versar summarized the transfer coefficients by re-entry day (separately and combined) and by maintenance task (separately and combined). Therefore, a total of 63 scenarios were evaluated by Versar (3 clothing combinations * 7 task combinations * 3 re-entry combinations). The maintenance tasks were combined because many of the tasks may be performed by most of the workers. The ARTF stated that it does not condone the wearing of less clothing than required by the EPA Worker Protection Standard; therefore, the study author only evaluated the long pants/long sleeve shirt scenario.

The corrected exposure values (µg) and transfer coefficients by replicate number for the outer dosimeters, inner dosimeters, face/neck wipes, and hand washes can be found in Tables 5 through 8, respectively.

The total dermal exposure transfer coefficient for a worker wearing a long sleeved shirt and long pants is the sum of the inner dosimeter transfer coefficients for each body part, the hand wash transfer coefficient, and the face/neck wipe transfer coefficient. These values calculated by Versar can be found in Table 9. On re-entry day 1, the geometric mean values for the various individual activities ranged from 289 cm²/hr (cup changing) to 1,583 cm²/hr (miscellaneous grooming) and the geometric mean value for the combination of the tasks was 680 cm²/hr. On re-entry day 2, the geometric mean values for the various individual activities ranged from 258 cm²/hr (greens mowing) to 3,006 cm²/hr (irrigation repair) and the geometric mean value for the combination of the tasks was 845 cm²/hr. For the combination of the re-entry days, the geometric mean values for the various individual activities ranged from 285 cm²/hr (greens mowing) to 1,771 cm²/hr (irrigation repair) and the geometric mean value for the combination of the tasks was 758 cm²/hr.

The total dermal exposure transfer coefficient for a worker wearing long pants and a t-shirt is the sum of the inner dosimeter transfer coefficients for each body part, the outer-dosimeter lower arms, the hand wash transfer coefficient, and the face/neck wipe transfer coefficient. These values calculated by Versar can be found in Table 10. On re-entry day 1, the geometric mean values for the various individual activities ranged from 409 cm²/hr (greens mowing) to 2,116 cm²/hr (miscellaneous grooming) and the geometric mean value for the combination of the tasks was 1,027 cm²/hr. On re-entry day 2, the geometric mean values for the various individual activities ranged from 609 cm²/hr (greens mowing) to 4,525 cm²/hr (irrigation repair) and the geometric mean value for the combination of the tasks was 1,794 cm²/hr. For the combination of the re-entry days, the geometric mean values for the various individual activities ranged from 499 cm²/hr (greens mowing) to 2,706 cm²/hr (irrigation repair) and the geometric mean value for the combination of the tasks was 1,358 cm²/hr.

The total dermal exposure transfer coefficient for a worker wearing short pants and a t-shirt is the sum of the inner dosimeter transfer coefficients for each body part, the outer-dosimeter lower arms and lower legs, the hand wash transfer coefficient, and the face/neck wipe transfer coefficient. These values calculated by Versar can be found in Table 11. On re-entry day 1, the geometric mean values for the various individual activities ranged from 409 cm²/hr (greens mowing) to 2,116 cm²/hr (miscellaneous grooming) and the geometric mean value for the combination of the tasks was 1,027 cm²/hr. On re-entry day 2, the geometric mean values for the various individual activities ranged from 609 cm²/hr (greens mowing) to 4,525 cm²/hr (irrigation repair) and the geometric mean value for the combination of the tasks was 1,794 cm²/hr. For the combination of the re-entry days, the geometric mean values for the various individual activities ranged from 499 cm²/hr (greens mowing) to 2,706 cm²/hr (irrigation repair) and the geometric mean value for the combination of the tasks was 1,358 cm²/hr.

A summary of the dermal transfer coefficients calculated by Versar by activity type, reentry day, and clothing scenario is provided in Table 12.

Versar calculated the inhalation exposure in μg/hour for each maintenance activity and all activities combined. These values calculated by Versar can be found in Table 13. Versar used the NAFTA light activity breathing rate (16.7 L/min) to calculate the air concentration in μg/m³ and the inhalation exposure in μg/hour. Residues were only detected at a level above the LOQ in one changing cup replicate, two irrigation repair replicates, and two miscellaneous repair replicates. For residues less than the LOQ (0.01 μg), a value of ½ LOQ (0.005 μg) was used in all calculations. No residues required correction for field fortification recoveries because all recoveries were >90%. On re-entry day 1, the average inhalation exposure values for the various individual activities ranged from 0.014 μg/hr (fairway mowing) to 0.140 μg/hr (cup changing) and the average inhalation exposure values for the various individual activities ranged from 0.013 μg/hr (irrigation repair) to 0.113 μg/hr (miscellaneous grooming) and the average inhalation exposure value for the combination of the tasks was 0.030 μg/hr. For

the combination of the re-entry days, the average inhalation exposure value for the various individual activities ranged from $0.015~\mu g/hr$ (fairway mowing) to $0.090~\mu g/hr$ (miscellaneous grooming) and the average inhalation exposure value for the combination of the tasks was $0.037~\mu g/hr$.

Versar summarized the distribution of residue on body parts for all three total dermal exposure clothing scenarios for the combination of all tasks. These values calculated by Versar can be found in Table 14. For the combination of re-entry days, the residues with significant percentages (i.e., >10%) were found on the hands (60%), lower leg (16%), and lower arm (14%) for the long pants/long-sleeve shirt scenario, the hands (32%) and lower arms (53%) for the long pants/t-shirt scenario, and the lower legs (79.0%) and lower arms (12%) for the short pants/t-shirt scenario.

III. DISCUSSION

A. LIMITATIONS OF THE STUDY:

Although the purpose of this study was to calculate transfer coefficients, the data were generated from studies designed to fulfill the requirements of Series 875 Occupational and Residential Exposure Test Guidelines. The data presented in this study met the majority of the pertinent guidelines. The issues of concern are:

- (1) The transfer coefficients exhibited a high degree of variability within each task monitored. As a result, the standard deviations calculated for many tasks were greater than the average residue value (68% of the scenarios evaluated by Versar). The reason for the variability was not reported. It appears that the transfer coefficients for the second trial (Study Days 3 and 4) were generally higher than the corresponding transfer coefficients from the first trial (Study Days 1 and 2). It also appears that the worker-specific TTR values from the second trial were generally lower than the TTR values from the first trial. For a few tasks, a high standard deviation can be attributed to a replicate with an extremely large or small residue value within the data set. These values were not discarded because there was no experimental basis for exclusion.
- (2) Many of the field residues were outside of the field fortification range.

 Typically, the residues were less than the lowest fortification level (up to 160 times less).
- (3) Only one location were used in this study (Oregon).
- (4) Irrigation data was not provided for the duration of the field study.
- (5) A rainfall event occurred on the morning of Study Day 3 (Second Trial, 1 Day after Application) prior to the monitoring period. Additionally, a light drizzle was apparent for 20 minutes in the afternoon on this monitoring day.
- (6) The guidelines recommend a minimum of 15 replicates per activity (5 replicates on 3 monitoring periods). In this study, a total of 6 to 8

- replicates were collected at each re-entry time (1 and 2 days after application), with 3 to 4 total replicates per activity (re-entry days combined).
- (7) The protocol target application rate was set at 5.5 lb ai/acre; however, the maximum label recommended application rate for a single application was 11.3 lbs ai/A.
- (8) Breakthrough testing and a retention study of particulate levels and vapor phase levels on the air fiberglass filters were either not performed or not reported in the Study Report.
- (9) Data from a 9-month storage stability test that was conducted previously were not provided in the Study Report; however, field fortification and travel recoveries indicated acceptable storage stability.
- (10) The upper arm, front & rear torso, and upper leg portions of the outer dosimeters were not analyzed. (11) There was uncertainty in the estimates of total acreage for greens and fairways areas treated.

B. CONCLUSION:

The transfer coefficients calculated by the study author and Versar for the long pants/long sleeves clothing scenario were similar. The difference in the values is due to the different correction methods used by the study author and Versar. The study author corrected all raw residues for all recoveries (to 100% recovery) and used the average recovery value for all monitoring days. Versar only corrected raw residues for field fortification recoveries <90% and used the average recovery for the corresponding monitoring day. A comparison of Versar's and the Registrant's transfer coefficient values for the long pants/long sleeves clothing scenario are present below.

Comparison of Transfer	Coefficients as	calculated by	Versar and the	Registrant			
Antivity	Transfer Coefficients (cm²/hr)						
Activity	Arithmeti	c Mean					
	Registrant	Versar	Registrant	Versar			
Cup Changing	1,440	1,311	547	519			
Greens Mowing	903	847	309	285			
Greens Watering	3,690	3,291	1,390	1,228			
Fairways Mowing	899	791	588	542			
Miscellaneous Grooming	4,070	3,860	1,140	1,086			
Irrigation Repair	10,800	10,534	1,750	1,771			
All Tasks Combined	3,720	3,517	810	758			

Ta	able 5. Tr	ansfer Coefficients for	Each Out	er Dosimet	er Body P	art
Replicate	Study Day	Body Part	Corrected Residue Value (µg)	TTR (μg/cm²)	Time Worked (hours)	Transfer Coefficient Each Body Part (cm ² /hr)
		Cup Changing (C	Freenway A	ctivity)		
CCI	1	Outer Pants (lower leg)	3,295	2.80	1.60	735
CCI		Outer Shirt (lower arm)	3.86	2.80	1.60	0.862
CC2	1	Outer Pants (lower leg)	10,768	2.12	2.20	2,304
	I .	Outer Shirt (lower arm)	1,205	2.12	2.20	258
CC3	2	Outer Pants (lower leg)	3,476	1.36	2.68	954
		Outer Shirt (lower arm)	221	1.36	2.68	60.7
CC4	3	Outer Pants (lower leg)	475	0.503	1.82	520

Ta	able 5. Tr	ansfer Coefficients for	Each Out	er Dosimet	er Body P	art de la company
Replicate	Study Day	Body Part	Corrected Residue Value (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficient Each Body Part (cm²/hr)
		Outer Shirt (lower arm)	19.6	0.503	1.82	21.5
CC5	4	Outer Pants (lower leg)	513	0.065	1.67	4,728
CCJ		Outer Shirt (lower arm)	36.0	0.065	1.67	332
CC6	4	Outer Pants (lower leg)	761	0.059	1.27	10,224
CCO	+	Outer Shirt (lower arm)	300	0.059	1.27	4,028
		Greens Mowing (C	Greenway A	Activity)		
GM1	1	Outer Pants (lower leg)	2,433	1.63	2.67	559
GIVII		1	Outer Shirt (lower arm)	56.5	1.63	2.67
GM2	1	Outer Pants (lower leg)	5,696	1.52	3.90	961
GM2	1	Outer Shirt (lower arm)	147	1.52	3.90	24.8
GM3	2	Outer Pants (lower leg)	5,248	1.01	2.97	1,751
GMS	_	Outer Shirt (lower arm)	569	1.01	2.97	190
GM4	2	Outer Pants (lower leg)	339	0.911	2.22	168
OM4	4 2	Outer Shirt (lower arm)	54.4	0.911	2.22	27.0
GM5	3	Outer Pants (lower leg)	1,700	0.483	2.70	1,303
OM)	,,	Outer Shirt (lower arm)	462	0.483	2.70	354

T	able 5. Tr	ansfer Coefficients for	Each Out	er Dosimet	er Body P	art
Replicate:	Study# Day#	Body Part	Corrected Residue Value (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer: Coefficient Each Body Part (cm²/hr)
GM6	3	Outer Pants (lower leg)	3,356	0.445	2.57	2,935
Givio	3	Outer Shirt (lower arm)	133	0.445	2.57	116
GM7	4	Outer Pants (lower leg)	4,648	0.071	2.87	22,733
O.W17	T	Outer Shirt (lower arm)	340	0.071	2.87	1,664
GM8	4	Outer Pants (lower leg)	2,936	0.076	2.20	17,611
0,410	i -T	Outer Shirt (lower arm)	111	0.076	2.20	663

		Greens Watering (Greenway	Activity)		
GW1	1	Outer Pants (lower leg)	1,347	0.232	3.02	1,925
OW t	1	Outer Shirt (lower arm)	429	0.232	3.02	613
GW2	1	Outer Pants (lower leg)	2,813	0.232	2.83	4,282
0.00		Outer Shirt (lower arm)	348	0.232	2.83	529
GW3	2	Outer Pants (lower leg)	1,015	0.439	3.12	742
0,,,	<u> </u>	Outer Shirt (lower arm)	675	0.439	3.12	494
GW4	2	Outer Pants (lower leg)	5,874	0.439	3.00	4,463
0,117	OW4 2	Outer Shirt (lower arm)	631	0.439	3.00	479
GW5	3	Outer Pants (lower leg)	1,269	0.132	2.32	4,140

Replicate	Study Day		Body Part	Each Out Corrected Residue Value (µg)	T	rr cm²)	Tin Wor (hou	ne ked	Coe Eacl	ensfer fficient h Body Part n ² /hr)	
			Outer Shirt (low arm)	ver 3	73	0.1	32	2.	32	1,21	6
CW	GW6 3	Outer Pants (lov leg)	ver 4	08	0.2	06	2.	28	867		
J GW		3	Outer Shirt (low arm)	ver 1	79	0.2	06	2.	28	380	'
CH	7.7	4	Outer Pants (low leg)	ver 4,	162	0.0	14	2.	23	138,1	02
GW7 4		7	Outer Shirt (low arm)	ver 2	03	0.0	14	2.	23	6,28	0
CN	GW8 4	4	Outer Pants (lov leg)	ver 6	63	0.0	18	2.	10	17,66	51
G W		-+	Outer Shirt (low arm)	ver 6	12	0.0	18	2.	10	16,30)9
			Fairway Mov	ving (Fair	way A	Activit	y)				
FM		1	Outer Pants (lov leg)	ver 1,	440	1.4	16	2.	.22	445	<u>,</u>
1,161		1	Outer Shirt (low arm)	ver 1	10	1.4	16	2.	.22	34.1	L
FM	12	1	Outer Pants (lov leg)	ver 10	,980	1.0)4	4.	.00	2,62	9
1710	1	1	Outer Shirt (lov arm)	ver 12	,643	1.0)4	4.	.00	3,02	8
ENA	13	2	Outer Pants (lov	ver 4,	708	0.9	03	3.	.60	1,44	8
FM3 2	4	Outer Shirt (lov arm)	ver 4,	105	0.9	03	3.	.60	1,26	2	
FM	14	2	Outer Pants (lov leg)	wer 2,	268	1.3	26	2	.02	893	3
FIV	1-+	۷	Outer Shirt (lov arm)	ver 1	91	1.2	26	2	.02	75.3	3

eplicate	Study Day		Body Part Res		TTR g/cm²) Tir Wor (hou	ne Coe ked Eac irs)	ansfer fficient h Body Part n ² /hr)	
FM	5	3	Outer Pants (lower leg)	677	0.895	4.47	169	
1,141		_	Outer Shirt (lower arm)	2,434	0.895	4.47	609	
FM	6	3	Outer Pants (lower leg)	4,738	1.09	2.60	1,669	
Livi		3	Outer Shirt (lower arm)	648	648 1.09		229	
FM	7	4	Outer Pants (lower leg)	1,794	0.084	3.97	5,397	
LIVI		4	Outer Shirt (lower arm)	1,388	0.084	3.97	4,176	
FM	Q	4	Outer Pants (lower leg)	271	0.110	2.27	1,090	
1 141		.	Outer Shirt (lower arm)	125	0.110	2.27	504	
			Irrigation Repair	(Fairway	Activity)			
IR	9	1	Outer Pants (lower leg)	9,835	0.642	2.68	5,708	
н		1	Outer Shirt (lower arm)	667	0.642	2.68	387	
IR	,	ı	Outer Pants (lower leg)	3,975	0.182	3.40	6,431	
117.2			Outer Shirt (lower arm)	219	0.182	3.40	354	
IRS	,	2	Outer Pants (lower leg)	2,418	0.989	2.98	820	
IK.		4	Outer Shirt (lower arm)	434	0.989	2.98	147	
IR	4	2	Outer Pants (lower leg)	5,752	0.252	3.03	7,536	

licate	Study Day		Rody Part	orrected esidue Value (µg)		ΓR cm²)	Tin Wor (hou	ne ked	Trace	ansfer fficient h Body Part n ² /hr)	
			Outer Shirt (lower arm)	26	59	0.2	52	3.	03	352	
IR5		3	Outer Pants (lower leg)	2,8	354	0.9	83	3.	62	803	
IKJ		5	Outer Shirt (lower arm)	2,3	362	0.9	83	3.	62	664	
IR6		3	Outer Pants (lower leg)	2,0	90	0.2	18	3.08		3,112	
INO		3	Outer Shirt (lower arm)	60	668 0.218		:18	3.08		995	
IR7		4	Outer Pants (lower leg)	6,8	814 0.042		942	3.65		44,658	
		-	Outer Shirt (lower arm)	40	59	0.042		3.	.65	3,075	
IR8		4	Outer Pants (lower leg)	1,4	1,494 0.0		21	3	.22	22,575	
INC		- r	Outer Shirt (lower arm)	7.	736 0.02		21	3	.22	11,118	
			Miscellaneous Groo	ming (I	airw	ay Ac	tivity	·)			
MG	1	1	Outer Pants (lower leg)	1,9	911	0.1	82	3	.48	3,017	
WIO		•	Outer Shirt (lower arm)	14	149 0.1		.182 3.48		.48	236	
MG	,	2	Outer Pants (lower leg)	4,7	717	0.8	326	2	.72	2,103	
IVIC			Outer Shirt (lower arm)	86	5.4	0.82		2	.72	38.5	
MG	3	2	Outer Pants (lower leg)	1,4	105	0.2	259	3	.32	1,636	
IATAT		4	Outer Shirt (lower arm)	1,1	140	0.259		3	.32	1,328	

	· Ta	able 5.	Trai	nsfer	Coefficients for	Each	Out	er Do	simeto	er Bo	dy Pa	ert	the Mark the Sa	
Repl	licate	Stud Day			Body Part	Res Va	ected idue lue g)	1000	rR cm²)	Tin Wor (hou	ked	Coe Eac	nnsfer fficient h Body Part n ² /hr)	
	MG4		4 3		Outer Pants (lower leg)		2,9	67	1.07		3.22		863	
	IVIC	,	J		Outer Shirt (lov arm)	ver	35	56	1.0)7	3.2	22	104	
	MG5		5 3		Outer Pants (lower leg)		1,7	49	0.136		2.7	77	4,657	
	IMIC		٥		Outer Shirt (lov arm)	ver		11	0.1	36	2.7	77	296	
	MC	36	4		Outer Pants (lov leg)	wer	4,6	570	0.0	69	3.1	12	21,619	
	IVIC		7		Outer Shirt (lov	ver	40	———)4	0.0	69	3.1	12	1,873	

Footnotes:

- The LOQ for the outer dosimeter is 1 μg .
- Corrected residue data represents corrected raw residue using the closest field fortification level recoveries for each corresponding reentry day.
- CC cup changing: GM greens mowing; GW greens watering; FM fairway mowing; IR irrigation repair; MG misce laneous grooming
- Study Day 1 = Reentry 1 Day After Single Application on First Half of Course (Trial #1)

 - Study Day 2 = Reentry 2 Days After Single Application on First Half of Course (Trial #1) Study Day 3 = Reentry 1 Day After Single Application on Second Half of Course (Trial #2)
 - Study Day 4 = Reentry 2 Days After Single Application on Second Half of Course (Trial #2)

Table	e 6. Transi	er Coefficient		h Inner Do Osimeter	simeter B	ody Parti	and Total	inner -
Replicate	Study Day	Body Part	Correcte d Residue Value (µg)	Total Dosimete r Correcte d Value (µg)	TTR (µg/cm ²)	Time Worked (hours)	Transfer Coefficie nt Each Body Part (cm²/hr)	Trans er Coefficie nt Total Dosinet er (cm²/lr)
		Cu	p Changi	ng (Greens	Activity)			
		Lower Arm	9.33		2.80	1.60	2.08	
		Upper Arm	0.858		2.80	1.60	0.191	
CCI	1	Front Torso	3.21	1,900	2.80	1.60	0.716	424
CCI	1	Rear Torso	17.0	1,900	2.80	1.60	3.78	424
		Lower Leg	1,850		2.80	1.60	413	[
:		Upper Leg	19.1	-	2.80	1.60	4.25	
		Lower Arm	55.1		2.12	2.20	11.8	
		Upper Arm	4.01	365	2.12	2.20	0.857	
CC2		Front Torso	6.49		2.12	2.20	1.39	78.1
CC#		Rear Torso	3.17		2.12	2.20	0.677	70.1
		Lower Leg	287		2.12	2.20	61.4	1
;		Upper Leg	9.59		2.12	2.20	2.05	
		Lower Arm	88.3		1.36	2.68	24.2	
;		Upper Arm	3.61		1.36	2.68	0.990	
CC3	· • • • • • • • • • • • • • • • • • • •	Front Torso	3.87	160	1.36	2.68	1.06	43.8
CC3	atte	Rear Torso	5.48	100	1.36	2.68	1.50	45.8
		Lower Leg	40.7		1.36	2.68	11.2	
		Upper Leg	17.6		1.36	2.68	4.83	
CC4		Lower Arm	4.51		0.503	1.82	4.94	
		Upper Arm	1.70	17.3	0.503	1.82	1.86	
	3	Front Torso	2.17		0.503	1.82	2.37	18.9
	3	Rear Torso	1.41] 1/.5	0.503	1.82	1.54	10.7
		Lower Leg	5.42		0.503	1.82	5.94	
		Upper Leg	2.04		0.503	1.82	2.23	

Table	e 6. Transi	er Coefficien		h Inner Do Josimeter	simeter B	ody Part	and Total J	nner
Replicate	Study Day	Body Part	Correcte d Residue Value (µg)	Total Dosimete r Correcte d Value (µg)	TTR- (µg/cm²)	Time Worked (hours)	Transfer Coefficie Int Each Body Part (cm²/hr)	Transter Coefficient Int Total Dosiment er (cm²/hr)
		Lower Arm	5.76		0.065	1.67	53.1	
		Upper Arm	4.67		0.065	1.67	43.1	
CC5	1	Front Torso	1.84	23.0	0.065	1.67	17.0	212
	4	Rear Torso	2.20	25.0	0.065	1.67	20.3	212
		Lower Leg	4.77	-	0.065	1.67	44.0	
· ·		Upper Leg	3.79		0.065	1.67	34.9	
CC6	4	Lower Arm	131		0.059	1.27	1,758	2,304
		Upper Arm	1.24		0.059	1.27	16.7	
		Front Torso	5.18	171	0.059	1.27	69.6	
		Rear Torso	1.92		0.059	1.27	25.8	2,304
ļ		Lower Leg	29.2	-	0.059	1.27	392	
•		Upper Leg	3.10	1	0.059	1.27	41.6	
		Cup Cl	hanging -	1 Day Afte	r Applicat	tion	<u> </u>	-
	Av	erage		761				174
	Standard	d Deviation		1,001				219
	Geome	etric Mean		229	-			86
		Cup Ch	nanging - :	2 Days Afte	er Applica	tion		† —
	Av	erage		118				853
	Standard	1 Deviation		82	1			1,259
	Geome	tric Mean		86	278			
		Cup Ch	anging -	Re-entry D	ays Comb	ined		
	Av	erage		439				513
	Standard	d Deviation	726]			890	
	Geome	etric Mean		140				154
		Gre	eens Mow	ing (Green	s Activity)			
GMI	1	Lower Arm	43.5	88.6	1.63	2.67	10.0	20.4

Table	e 6. Transi	er Coefficien		h Inner Do osimeter	simeter Bo	dy Part	and Total I	nner
Replicate	Study Day	Body Part	Correcte d Residue Value (µg)	Total Dosimete I Correcte d Value (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficie nt Each Body Part (cm²/hr)	Transfer Coefficie nt Total Dosimet er (cm²/hr)
		Upper Arm	3.70		1.63	2.67	0.850	
		Front Torso	3.22		1.63	2.67	0.741	
		Rear Torso	3.86		1.63	2.67	0.886	
		Lower Leg	26.1		1.63	2.67	6.01	
		Upper Leg	8.20		1.63	2.67	1.88	
		Lower Arm	12.9		1.52	3.90	2.18	
	THE CONTRACTOR OF THE CONTRACT	Upper Arm	2.71]	1.52	3.90	0.458	
GM2		Front Torso	3.74	58.7	1.52	3.90	0.632	9.91
OME		Rear Torso	2.31	36.7	1.52	3.90	0.390	7.71
		Lower Leg	29.7		1.52	3.90	5.01	
		Upper Leg	7.40		1.52	3.90	1.25	
		Lower Arm	2.47		1.01	2.97	0.82	
		Upper Arm	0.500	1	1.01	2.97	0.167	
GM3	⁻¹⁰)	Front Torso	0.500	91.0	1.01	2.97	0.167	30.4
OMD	Street	Rear Torso	0.500	91.0	1.01	2.97	0.167] 50.4
		Lower Leg	21.5	1	1.01	2.97	7.17	
	ļ	Upper Leg	65.6		1.01	2.97	21.9	
		Lower Arm	12.5		0.91	2.22	6.21	
	<u> </u>	Upper Arm	1.08	1	0.91	2.22	0.534	
GM4	2	Front Torso	1.75	25.5	0.91	2.22	0.866	126
UIVI4		Rear Torso	0.500	7 23.3	0.91	2.22	0.248	12.6
	[Lower Leg	5.45	1	0.91	2.22	2.70	
		Upper Leg	4.21		0.91	2.22	2.09	1
GM5	3	Lower Arm	75.6	441	0.483	2.70	58.0	338
		Upper Arm	0.500		0.483	2.70	0.383	
		Front Torso	29.3		0.483	2.70	22.5	

Tabl	e 6. Transf	er Coefficien	and the second of the second o	h Inner Do osimeter	simeter Bo	dy Part	and Total	nner	
Replicate	Study Day	Body Part	Correcte d Residue Value (µg)	Total Dosimete r Correcte d Value (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficie nt Each Body Part (cm²/hr)	Transf Coeffice nt Tot Dosim er (cm²/h	ie il et
		Rear Torso	1.73		0.483	2.70	1.32		
		Lower Leg	292		0.483	2.70	224		
		Upper Leg	41.2		0.483	2.70	31.6		
		Lower Arm	3.42	,	0.445	2.57	2.99		
		Upper Arm	2.30		0.445	2.57	2.01		
GM6	3	Front Torso	2.43	3,945	0.445	2.57	2.12	3,451	
CIVIO	⁷	Rear Torso	2.34] 3,943	0.445	2.57	2.04	3,431	ļ
	•	Lower Leg	3,929		0.445	2.57	3,437		
	-	Upper Leg	5.95		0.445	2.57	5.21	-	l
		Lower Arm	30.1		0.071	2.87	147		<u> </u>
		Upper Arm	0.500		0.071	2.87	2.45		l
GM7	<u> </u>	Front Torso	2.49	140	0.071	2.87	12.2	684	l
GM7		Rear Torso	2.54	140	0.071	2.87	12.4	004	l
		Lower Leg	100]	0.071	2.87	490		l
		Upper Leg	4.08		0.071	2.87	20.0		
		Lower Arm	3.18		0.076	2.20	19.1		ľ
		Upper Arm	0.500		0.076	2.20	3.00		l
GM8	1	Front Torso	1.73	16.2	0.076	2.20	10.4	96.9	
CIVIO		Rear Torso	0.500	10.2	0.076	2.20	3.00	90.9	l
		Lower Leg	7.92		0.076	2.20	47.5		
		Upper Leg	2.33		0.076	2.20	14.0		
		Greens	Mowing -	· 1 Day Aft	er Applica	tion			Ī
	Av	erage_		1,133				955	
	Standard	d Deviation		1,883	_			1,67	1
	Geome	tric Mean		308				124	
		Greens	Mowing -	2 Days Af	ter Applica	ation			

Table	e 6. Transi	er Coefficien		h Inner Do osimeter	simeter B	ody Part	and Total	nner
Replicate	Study Day	Body Part	Correcte d Residue Value (µg)	Total Dosimete r Correcte d Value (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficie nt Each Body Part (cm²/hr)	Transfer Coefficient Total Dosimer er (cm²/hr)
	Av	erage		68				206
	Standarc	Deviation		58				321
	Geome	tric Mean		48				71
		Greens N	Nowing -	Re-entry I	Days Com	bined		
	Av	erage		601				580
	Standard	l Deviation		1,358				1,184
	Geome	tric Mean		122				94
		Gree	ens Water	ing (Greer	ns Activity)		
		Lower Arm	201		0.232	3.02	287	
		Upper Arm	18.3	}	0.232	3.02	26.2	
GW1	t	Front Torso	75.4	354	0.232	3.02	108	506
3,,1	•	Rear Torso	9.6		0.232	3.02	13.7	300
İ		Lower Leg	40.3]	0.232	3.02	57.7	
		Upper Leg	8.99		0.232	3.02	12.9	
		Lower Arm	195		0.232	2.83	297	
		Upper Arm	3.58		0.232	2.83	5.46]
GW2	1	Front Torso	6.06	292	0.232	2.83	9.22	445
J 11 2	1	Rear Torso	5.83		0.232	2.83	8.88] 773
		Lower Leg	64.9		0.232	2.83	98.8	
		Upper Leg	17.1		0.232	2.83	26.0	
		Lower Arm	59.1		0.439	3.12	43.2	
		Upper Arm	3.10		0.439	3.12	2.27	
GW3	2	Front Torso	5.48	199	0.439	3.12	4.01	146
G ## 5	ئە	Rear Torso	5.24]	0.439	3.12	3.83	140
		Lower Leg	62.2		0.439	3.12	45.5	
:		Upper Leg	64.2		0.439	3.12	46.9	

Tabl	e 6. Trans	fer Coefficien	and the second second	h Inner Do Osimeter	simeter Bo	ody Part	and Total	nner	
Replicate	Study Day	Body Part	Correcte d Residue Value (µg)	Total Dosimete r Correcte d Value (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficie nt Each Body Part (cm²/hr)	Transfe Coeffici nt Tota Dosime er (cm²/h	ie L
		Lower Arm	41.4		0.439	3.00	31.5		
		Upper Arm	3.08		0.439	3.00	2.34	į	
GW4	2	Front Torso	3.42	78	0.439	3.00	2.60	59.6	
0 ***	nare .	Rear Torso	5.87	70	0,439	3.00	4.46	39.0	
		Lower Leg	11.4		0.439	3.00	8.63		
		Upper Leg	13.2		0.439	3.00	10.0		
		Lower Arm	166		0.132	2.32	543		
		Upper Arm	30.9		0.132	2.32	101		
GW5	3	Front Torso	6.34	256	0.132	2.32	20.7	834	
UWJ		Rear Torso	27.2	230	0.132	2.32	88.9	0.54	
	į	Lower Leg	18.4	1	0.132	2.32	59.9		
		Upper Leg	6.46		0.132	2.32	21.1	1	
		Lower Arm	21.2		0.206	2.28	45.0		Γ
		Upper Arm	0.500		0.206	2.28	1.06]	
GW6	3	Front Torso	1.59	29,4	0.206	2.28	3.38	62.5	
OWO		Rear Torso	0.500	29,4	0.206	2.28	1.06	02.3	١
	į	Lower Leg	2.57		0.206	2.28	5.46	1	l
		Upper Leg	3.04		0.206	2.28	6.47		
		Lower Arm	92.9		0.014	2.23	2,876		Γ
		Upper Arm	1.50		0.014	2.23	46.5		l
GW7	4	Front Torso	2.13	109	0.014	2.23	65.8	2 207	
0,44,	4	Rear Torso	1.31	109	0.014	2.23	40.5	3,387	Ì
		Lower Leg	5.54		0.014	2.23	172		
		Upper Leg	6.04	.04	0.014	2.23	187		
GW8	4	Lower Arm	5.79	22.7	0.018	2.10	154	605	1
		Upper Arm	0.500		0.018	2.10	13.3		

Tabl	e 6. Trans	fer Coefficien	N. P. 11.	h Inner Do osimeter	simeter B	ody Part	and Total I	nner
Replicate	Study Day	Body Part	Correcte d Residue Value (µg)	Total Dosimete I Correcte d Value (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficie nt Each Body Part (cm²/hr)	Transfer Coefficie nt Total Dosimet er (cm²/hr)
		Front Torso	2.36		0.018	2.10	62.9	
r.		Rear Torso	0.500		0.018	2.10	13.3	
		Lower Leg	11.4		0.018	2.10	303	
		Upper Leg	2.19		0.018	2.10	58.5	
		Greens '	Watering	- 1 Day Aft	ter Applica	ation		
	Av	erage/		233				462
	Standard	d Deviation		141				316
	Geome	etric Mean		167				329
		Greens V	Vatering -	2 Days Af	ter Applic	ation		
	Av	erage/		102				1,049
	Standard	d Deviation		74]			1,577
	Geome	etric Mean		79				365
		Greens V	Vatering -	Re-entry	Days Com	bined		
	Av	erage/		168				756
	Standard	d Deviation		126				1,099
	Geome	etric Mean		115				347
		Fair	way Mow	ing (Fairw	ay Activity	7)		
		Lower Arm	101		1.46	2.22	31.3	
		Upper Arm	4.95		1.46	2.22	1.53	
FM1	}	Front Torso	6.92	177	1.46	2.22	2.14	54.8
		Rear Torso	3.19		1.46	2.22	0.987	
		Lower Leg	16.8		1.46	2.22	5.20	
	1	Upper Leg	44.0		1.46	2.22	13.6	
FM2	1	Lower Arm	3,420	3,837	1.04	4.00	819	919
		Upper Arm	35.3		1.04	4.00	8.46	
		Front Torso	47.0		1.04	4.00	11.3	

Tabl	e 6. Transl	er Coefficien		h Inner Do Osimeter	simeter B	ody Part :	and Total	nner 🐾	
Replicate	Study Day	Body Part	Correcte d Residue Value (µg)	Total Dosimete I Correcte d Value (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficie nt Each Body Part (cm²/hr)	Transf Coeffice nt Tot Dosim er (cm ² /h	ie al et
		Rear Torso	25.7		1.04	4.00	6.16		
		Lower Leg	146		1.04	4.00	35.0		ļ
		Upper Leg	163		1.04	4.00	38.9		
		Lower Arm	616		0.90	3.60	190		
		Upper Arm	3.64		0.90	3.60	1.12		
FM3	2	Front Torso	23.3	738	0.90	3.60	7.16	227	
11115		Rear Torso	6.68	, 50	0.90	3.60	2.06		
		Lower Leg	58.1		0.90	3.60	17.9		
	·	Upper Leg	30.3		0.90	3.60	9.32		
		Lower Arm	30.2		1.26	2.02	11.9		
		Upper Arm	1.28		1.26	2.02	0.505		ļ
FM4	-71	Front Torso	2.03	61.2	1.26	2.02	0.797	24.1	
I 141-4		Rear Torso	2.50	01.2	1.26	2.02	0.986	24.1	Ì
		Lower Leg	21.9		1.26	2.02	8.62		
		Upper Leg	3.22		1.26	2.02	1.27		
		Lower Arm	1,900		0.90	4.47	475		
		Upper Arm	27.2		0.90	4.47	6.80		1
FM5	3	Front Torso	35.9	2,142	0.90	4.47	8.98	536	
1 1415		Rear Torso	38.5	2,172	0.90	4.47	9.63) 550	1
		Lower Leg	71.6		0.90	4.47	17.91	1	
		Upper Leg	69.0		0.90	4.47	17.25		
FM6	3	Lower Arm	34.4	145	1.09	2.60	12.11	51.0	
		Upper Arm	13.8		1.09	2.60	4.85		
		Front Torso	16.7		1.09	2.60	5.90		
		Rear Torso	6.94		1.09	2.60	2.44		
<u> </u>		Lower Leg	37.8		1.09	2.60	13.3		

Tabl	e 6. Transf	er Coefficien		h Inner Do osimeter	simeter B	ody Part	and Total	nner
Replicate	Study Day	Body Part	Correcte d Residue Value (µg)	Total Dosimete r Correcte d Value (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficie nt Each Body Part (cm²/hr)	Transfe Coeffici nt Total Dosime er (cm²/hr
		Upper Leg	35.0		1.09	2.60	12.3	
		Lower Arm	119		0.084	3.97	358	
		Upper Arm	4.17		0.084	3.97	12.5	
FM7	*	Front Torso	4.05	175	0.084	3.97	12.2	525
1 14.1.7	••	Rear Torso	1.20	1/3	0.084	3.97	3.60	
		Lower Leg	22.5		0.084	3.97	67.6	
	1	Upper Leg	23.8		0.084	3.97	71.6	1]
		Lower Arm	17.2		0.110	2.27	69.0	
	Upper Arm	1.65		0.110	2.27	6.62]	
FM8	4	Front Torso	1.88	30.4	0.110	2.27	7.55	122
TWIO	. →	Rear Torso	2.53		0.110	2.27	10.2	
		Lower Leg	3.44		0.110	2.27	13.8	1
		Upper Leg	3.74		0.110	2.27	15.0	}
		Fairway	Mowing	- 1 Day Af	ter Applica	ation		
	Av	erage		1,575				390
	Standard	1 Deviation		1,774	1			420
	Geome	tric Mean		678]			193
		Fairway	Mowing -	· 2 Days Af	ter Applic	ation		
	Av	erage		251				225
	Standard	l Deviation		331				217
	Geome	tric Mean		124		·		137
		Fairway	Mowing -	- Combine	d Re-entry	Days		
	Av	erage		913				307
	Standard Deviation			1,377				322
	Geome	etric Mean		290				162
		Irrig	gation Rep	air (Fairw	ay Activity	y)		

Table	6. Transf	er Coefficien		h Inner Do Oosimeter	simeter Bo	dy Part	and Total	nner
Replicate	Study Day	Body Part	Correcte d Residue Value (µg)	Total Dosimete r Correcte d Value (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficie nt Each Body Part (cm²/hr)	Transfer Coefficient Total Dosiment er (cm²/h
		Lower Arm	606		0.642	2.68	352	
		Upper Arm	9.34		0.642	2.68	5.42	[
IR1	vere .	Front Torso	7.90	1,454	0.642	2.68	4.59	844
	•	Rear Torso	17.8	1,454	0.642	2.68	10.3	
		Lower Leg	246		0.642	2.68	143	
		Upper Leg	567		0.642	2.68	329	
		Lower Arm	247		0.182	3.40	399	
		Upper Arm	32.0		0.182	3.40	51.8	
IR2	. !	Front Torso	7.24	424	0.182	3.40	11.7	686
111.2	1	Rear Torso	2.54	724	0.182	3.40	4.11	
		Lower Leg	97.8]	0.182	3.40	158	
		Upper Leg	37.3		0.182	3.40	60.3	
		Lower Arm	0.500		0.989	2.98	0.169	
		Upper Arm	81.7		0.989	2.98	27.7	
IR3	2	Front Torso	2.57	860	0.989	2.98	0.870	291
IKS	<i>-</i>	Rear Torso	24.4	1 000	0.989	2.98	8.28	291
		Lower Leg	93.3		0.989	2.98	31.6	
		Upper Leg	657		0.989	2.98	223	
		Lower Arm	618		0.252	3.03	810	
		Upper Arm	43.3		0.252	3.03	56.7	
IR4	2	Front Torso	50.9	1,044	0.252	3.03	66.7	1,368
11.4	IR4 2	Rear Torso	48.2	1,044	0.252	3.03	63.1] 1,300
-		Lower Leg	219		0.252	3.03	287	
		Upper Leg		0.252	3.03	84.7		
IR5	3	Lower Arm	886	4,649	0.983	3.62	249	1,308
		Upper Arm	36.5		0.983	3.62	10.3	

Table	e 6. Transi	er Coefficien	and the second s	h Inner Do osimeter	simeter B	ody Part	and Total	nner
Replicate	Study Day	Body Part	Correcte d Residue Value (µg)	Total Dosimete r Correcte d Value (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficie nt Each Body Part (cm²/hr)	Transte Coeffici nt Tota Dosime er (cm²/hr
		Front Torso	19.2		0.983	3.62	5.41	
		Rear Torso	17.9		0.983	3.62	5.03	
		Lower Leg	3,467		0.983	3.62	975	
		Upper Leg	223		0.983	3.62	62.7	
		Lower Arm	59.5		0.218	3.08	88.6	
		Upper Arm	6.42		0.218	3.08	9.6	
IR6	3	Front Torso	8.33	310	0.218	3.08	12.4	461
	,	Rear Torso	22.0	310	0.218	3.08	32.8	101
1		Lower Leg 181	0.218	3.08	270			
		Upper Leg	32.1		0.218	3.08	47.7	
	-	Lower Arm	31.6		0.042	3.65	207	
<u> </u>		Upper Arm	4.51		0.042	3.65	29.5	
IR7	4	Front Torso	7.06	163	0.042	3.65	46.3	1,065
TIC,	7	Rear Torso	7.18	103	0.042	3.65	47.1	1,003
		Lower Leg	80.4		0.042	3.65	527	
		Upper Leg	31.8		0.042	3.65	209	
		Lower Arm	107		0.021	3.22	1,617	
		Upper Arm	19.1		0.021	3.22	289	
IR8	4	Front Torso	5.33	4,877	0.021	3.22	80.5	73,705
110	-1	Rear Torso	6.34	4,677	0.021	3.22	95.9	
		Lower Leg	4,407		0.021	3.22	66,602	!
		Upper Leg	332		0.021	3.22	5,020	
		Irrigatio	n Repair	- 1 Day Af	ter Applic	ation		
	Av	erage		1,709				825
	Standard	l Deviation		2,027				358
	Geome	tric Mean		971				768

Tabl	e 6. Transi	er Coefficien	TO 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	h Inner Do Josimeter	simeter B	ody Part a	and Total l	nner
Replicate	Study Day	Body Part	Correcte d Residue Value (µg)	Total Dosimete r Correcte d Value (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficie nt Each Body Part (cm²/hr)	Transfe Coeffic nt Tota Dosime er (cm²/h
		Irrigation	n Repair -	· 2 Days Af	ter Applic	ation		
	Av	erage		1,736				19,107
	Standard	l Deviation		2,128				36,401
	Geome	tric Mean	_	918				2,365
		Irrigation	Repair -	Re-entry	Days Com	bined		
	Av	erage		1,722				9,966
	Standard	l Deviation		1,924				25,757
	Geome	tric Mean		944				1,348
	-		Miscella	neous Gro	oming	7-1		
		Lower Arm	135		0.182	3.48	213	
		Upper Arm	57.4		0.182	3.48	90.6	
MG1	1	Front Torso	40.4	11,019	0.182	3.48	63.7	17,398
		Rear Torso	75.6	- 1,0 2	0.182	3.48	119	,,,,,,
		Lower Leg	10,517		0.182	3.48	16,606	
		Upper Leg	193		0.182	3.48	305	ļ
		Lower Arm	8.92		0.826	2.72	3.98	
		Upper Arm	2.50		0.826	2.72	1.11	}
MG2	2	Front Torso	2.59	693	0.826	2.72	1.15	309
-		Rear Torso	2.57		0.826	2.72	1.14	
		Lower Leg	646]	0.826	2.72	288	
		Upper Leg	31.2		0.826	2.72	13.9	
MG3	2	Lower Arm	64.6	315	0.259	3.32	75.2	367
		Upper Arm	3.60		0.259	3.32	4.19	<u> </u>
		Front Torso	23.1		0.259	3.32	26.9	
		Rear Torso	67.3		0.259	3.32	78.4	
		Lower Leg	1.02		0.259	3.32	1.18	

Tabl	e 6. Transi	er Coefficient		h Inner Do osimeter	simeter Bo	ody Part a	and Total l	nner
Replicate	Study Day	Body Part	Correcte d Residue Value (µg)	Total Dosimete r Correcte d Value (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficie nt Each Body Part (cm²/hr)	Transfer Coeffic nt Total Dosime er (cm²/hi
		Upper Leg	155		0.259	3.32	181	
		Lower Arm	50.9		1.069	3.22	14.8	
		Upper Arm	3.41		1.069	3.22	0.992	
MG4	3	Front Torso	5.20	117	1,069	3.22	1.51	34.0
MO4	<u>-</u> 1	Rear Torso	4.64	117	1.069	3.22	1.35	34.0
		Lower Leg	46.9		1.069	3.22	13.6	
		Upper Leg	5.89		1.069	3.22	1.71	į
		Lower Arm	40.3	213	0.136	2.77	107	
		Upper Arm	4.40		0.136	2.77	11.7	
MG5	7	Front Torso	48.7		0.136	2.77	130	568
MO3	1G 5 3	Rear Torso	7.57		0.136	2.77	20.2	308
		Lower Leg	76.8		0.136	2.77	204	
		Upper Leg	35.3		0.136	2.77	94.1	
		Lower Arm	70.7		0.069	3.12	327	
		Upper Arm	17.5		0.069	3.12	81.1	
MG6	4	Front Torso	15.3	205	0.069	3.12	70.7	948
MOO	4	Rear Torso	6.51	203	0.069	3.12	30.1	740
		Lower Leg	56.3		0.069	3.12	261	
		Upper Leg	38.5		0.069	3.12	178	
		Miscellaneo	us Groom	ing - 1 Day	After Ap	plication		
	Av	erage		3,783			-	6,000
	Standard	d Deviation		6,267				9,875
	Geome	tric Mean		650				695
		Miscellaneou	ıs Groomi	ing - 2 Day	s After Ap	plication		
	Av	erage		404				541
	Standard	d Deviation		256				353

Table 6. Transfer Coefficients for E	Each Inner Do Dosimeter	simeter Bo	dy Part	and Total I	nner
Replicate Study Body Part Resid Valu (µg)	ue Correcte	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficie ent Each Body Part (cm²/hr)	Transfer Coefficie nt Total Dosimet er (cm²/hr)
Geometric Mean	355				475
Miscellaneous Groo	ming - Re-en	try Days C	Combined		
Average	2,094				3,270
Standard Deviation	4,377				6,928
Geometric Mean	480				575
All Mainten	ance Activitie	s Combine	ed		
All Activities	- 1 Day After	Applicati	on		
Average	1,465				1,320
Standard Deviation	2,558				3,666
Geometric Mean	417				269
All Activities	- 2 Days Afte	r Applicati	ion		
Average	463				3,933
Standard Deviation	1,029	1			15,606
Geometric Mean	152				318
All Activities	- Re-entry Da	ays Combi	ned		
Average	964				2,627
Standard Deviation	1,029				15,606
Geometric Mean	152				318

- The LOQ for the inner dosimeter is 1 µg.
- Corrected residue data represents corrected raw residue using the closest field fortification level recoveries for each corresponding reentry day.
- CC cap changing; GM greens mowing; GW greens watering; FM fairway mowing; IR irrigation repair; MG miscellaneous grooming
- Study Day 1 = Reentry 1 Day After Single Application on First Half of Course (Trial #1) Study Day 2 = Reentry 2 Days After Single Application on First Half of Course (Trial #1)
 - Study Day 3 = Reentry 1 Day After Single Application on Second Half of Course (Trial #2) Study Day 4 = Reentry 2 Days After Single Application on Second Half of Course (Trial #2)

Table 7. Transfe	r Coefficie	nts for Face/Neck	Wipes (Gree	ns and Fairw	ay Activities)
Replicate	Study Day	Corrected Residue Value (µg)	TTR (μg/cm²)	Time Worked (hours)	Transfer Coefficient (cm ² /hr)
	C	up Changing (Gre	ens Activity)	
CC1	1	0.500	2.80	1.60	0.111
CC2	1	0.500	2.12	2.20	0.107
CC3	2	0.500	1.36	2.68	0.137
CC4	3	1.54	0.503	1.82	1.68
CC5	4	0.500	0.065	1.67	4.61
CC6	4	0.500	0.059	1.27	6.72
	Cup C	Changing – 1 Day A	After Applic	ation	
Average		0.846			0.634
Standard Devi	ation	0.599		[0.908
Geometric M	lean	0.727			0.272
	Cup C	hanging – 2 Days	After Applic	cation	
Average		0.50			3.82
Standard Devi	ation	0.00			3.36
Geometric M	lean	0.50			1.62
	Cup C	hanging – Re-entr	y Days Com	bined	
Average		0.673			2.228
Standard Devi	ation	0.423			2.811
Geometric M	lean	0.603			0.663
	Gı	reens Mowing (Gr	eens Activity	y)	
GM1	1	0.500	1.63	2.67	0.115
GM2	1	0.500	1.52	3.90	0.084
GM3	2	0.500	1.01	2.97	0.167
GM4	2	1.25	0.911	2.22	0.619
GM5	3	3.17	0.483	2.70	2.43
GM6	3	1.06	0.445	2.57	0.924

Replicate	Study Day	Corrected Residue Value (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficient (cm²/hr)	
GM7	4	0.500	0.071	2.87	2.45	
GM8	4	0.500	0.076	2.20	3.00	
	Greens	s Mowing – 1 Day	After Applic	cation		
Averag	g e	1.308			0.889	
Standard Deviation		1.27			1.10	
Geometric	Mean	0.957	· ·	0.384		
	Greens	Mowing – 2 Days	After Appli	cation		
Averag	je	0.69			1.56	
Standard Deviation 0.38					1.38	
Geometric Mean		0.629			0.933	
	Greens	Mowing - Re-ent	ry Days Con	nbined		
Averag	ge	1.00			1.22	
Standard De	viation	0.93			1.21	
Geometric	Mean	0.78			0.60	
	Gr	eens Watering (G	reens Activit	(y)		
GWI	1	0.500	0.232	3.02	0.715	
GW2	1	0.500	0.232	2.83	0.761	
GW3	2	1.18	0.439	3.12	0.861	
GW4	2	2.42	0.439	3.00	1.84	
GW5	3	1.78	0.132	2.32	5.82	
GW6	3	0.500	0.206	2.28	1.06	
GW7 4		0.500	0.014	2.23	15.5	
GW8	4	0.500	0.018	2.10	13.3	
	Greens	Watering – 1 Day	After Appli	ication		
Averag	ge	0.821			2.09	
Standard De	viation	0.642			2.49	
Geometric	Mean	0.687			1.35	

Replicate	Study Day	Corrected Residue Value (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficient (cm²/hr)
	Greens	Watering – 2 Days	s After Appl	lication	
Average		1.15			7.87
Standard Devi	ation	0.903			7.60
Geometric M	ean	0.918			4.25
	Green V	Vatering – Re-ent	ry Days Con	nbined	
Average		0.985			4.98
Standard Devi	ation	0.746			6.08
Geometric M	ean	0.794			2.40
	Fair	rway Mowing (Fai	rway Activi	ty)	
FM1	1	1.45	1.46	2.22	().448
FM2	1	1.55	1.04	4.00	0.371
FM3	2	3.26	0.903	3.60	1.00
FM4	2	2.37	1.26	2.02	0.933
FM5	3	5.47	0.895	4.47	1.37
FM6	3	1.55	1.09	2.60	0.545
FM7	4	1.54	0.084	3.97	4.63
FM8	4	0.500	0.110	2.27	2.01
	Fairwa	y Mowing – 1 Day	After Appli	ication	
Average		2.50			0.683
Standard Devi	ation	1.98			0.462
Geometric M	ean	2.09			0.593
	Fairway	Mowing – 2 Days	s After Appl	lication	
Average		1.92			2.14
Standard Devi	ation	1.18			1.73
Geometric M	ean	1.56			1.72
	Fairway	Mowing - Re-ent	try Days Co	mbined	
Average		2.21			1.41

Replicate Study Day		Corrected Residue Value (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficient (cm²/hr)	
Standard Dev	iation	1.54		<u></u>	1.41	
Geometric N	Geometric Mean				1.01	
	Irri	gation Repair (Fai	irway Activi	ty)		
IR 1	1	0.500	0.642	2.68	0.290	
IR2	1	0.500	0.182	3.40	0.809	
IR3	2	2.41	0.989	2.98	0.815	
IR4	2	2.08	0.252	3.03	2.73	
IR5	3	1.27	0.983	3.62	0.357	
IR6	3	0.500	0.218	3.08	0.744	
IR7	4	0.500	0.042	3.65	3.28	
IR8	4	0.500	0.021	3.22	7.56	
	Irrigati	ion Repair – 1 Day	After Appli	ication		
Average	÷	0.692			0.550	
Standard Dev	iation	0.384			0.264	
Geometric M	/Iean	0.631			0.500	
	Irrigation	on Repair – 2 Day	s After Appl	ication		
Average	:	1.37			3.59	
Standard Dev	iation	1.02			2.84	
Geometric M	Леап	1.06		·-	2.72	
	Irrigatio	on Repair – Re-en	try Days Cor	mbined		
Average	ži p [*]	1.03				
Standard Dev	iation	0.798			2.48	
Geometric N	Aean	0.817			1.17	
	Miscell	aneous Grooming	(Fairway Ac	ctivity)		
MG1	1	0.500	0.182	3.48	0.789	
MG2	2	0.500	0.826	2.72	0.223	
MG3	MG3 2		0.259	3.32	4.25	

Replicate	Study Day	Corrected Residue Value (μg)	TTR (μg/cm²)	Time Worked (hours)	Transfer Coefficient (cm²/hr)
MG4	3	0.500	1.07	3.22	0.145
MG5	3	1.90	0.136	2.77	5.05
MG6	MG6 4		0.069	3.12	15.4
	Miscellaneo	ous Grooming – 1	Day After A _I	oplication_	
Average	,e	0.965			1.99
Standard Dev	viation	0.806			2.67
Geometric 3	Mean	0.780			0.834
	Miscellaneo	ous Grooming – 2 I	Days After A	pplication	
Average	;e	2.49			6.63
Standard Dev	viation	1.73			7.88
Geometric I	Mean	1.83			2.45
	Miscellaneo	ous Grooming – Re	entry Days	Combined	
Averag	je	1.73			4.31
Standard Dev	viation	1.47			5.84
Geometric I	Mean	1.19	1.43		
	All N	Maintenance Activ	ities Combin	ied	
	All A	ctivities – 1 Day A	fter Applicat	tion	
Averag	je	1.21			1.12
Standard Dev	viation	1.18			1.51
Geometric I	Mean	0.902			0.58
	All A	ctivities – 2 Days A	After Applica	tion	
Averag	<i>je</i>	1.34			4.18
Standard Dev	viation	1.10	4		4.77
Geometric 1	Mean	0.979			2.05
	All Ac	ctivities – Re-entry	Days Comb	ined	
Averag	ie	1.28			2.65
Standard Dev	viation	1.13	[3.82

Table 7. Transfer Coefficien	Table 7. Transfer Coefficients for Face/Neck Wipes (Greens and Fairway Activities)								
Replicate Study Day	Corrected Residue Value (µg)	TTR Time Worked (μg/cm²) (hours)	Transfer Coefficient (cm²/hr)						
Geometric Mean	0.940		1.09						

- The LOQ for face/neck wipe is 1 μg. Residue values < LOQ were treated as ¼ LOQ (0.500 μg).
- Corrected residue data represents corrected raw residue using the closest field fortification level recoveries for each corresponding reentry day.
- CC cup changing; GM greens mowing; GW greens watering; FM fairway mowing; IR irrigation repair; MG miscellaneous grooming
- Study Day 1 = Reentry 1 Day After Single Application on First Half of Course (Trial #1)
 Study Day 2 = Reentry 2 Days After Single Application on First Half of Course (Trial #1)
 Study Day 3 = Reentry 1 Day After Single Application on Second Half of Course (Trial #2)
 Study Day 4 = Reentry 2 Days After Single Application on Second Half of Course (Trial #2)

Replicate	Study Day	Total Corrected Handwash (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficient (cm²/hr)
	<u> </u>	Cup Changing (Gre	ens Activit	y)	
CC1	1	419	2.80	1.60	93.4
CC2	1	125	2.12	2.20	26.7
CC3	2	143	1.36	2.68	39.2
CC4	3	389	0.503	1.82	426
CC5	4	205	0.065	1.67	1,887
CC6	4	171	0.059	1.27	2,301
	Cu	o Changing – 1 Day	After Appli	cation	
Av	erage	311			182
Standard	l Deviation	162		214	
Geome	tric Mean	273		102	
	Cup	Changing – 2 Days	After Appl	ication	
Αv	erage	173			1,409
Standarc	l Deviation	31			1,204
Geome	tric Mean	171		Ī	554
	Cup	Changing – Re-enti	y Days Cor	nbined	
Av	erage	242			796
Standard	Deviation	129		<u>-</u>	1,025
Geome	tric Mean	216	- 		238
		Greens Mowing (Gr	eens Activi	ty)	
GM1	1	297	1.63	2.67	68.1
GM2	1	230	1.52	3.90	38.8
GM3	2	29.7	1.01	2.97	9,91
GM4	2	224	0.911	2.22	111
GM5	3	324	0.483	2.70	249
GM6	3	425	0.445	2.57	372
GM7	4	159	0.071	2.87	777

Table 8.	. Transfer Coef	ficients for Hand Wa	shes (Greer	s and Fairv	vay Activities)
Replicate	Study Day	Total Corrected Handwash (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficient (cm²/hr)
GM8	4	83.5	0.076	2.20	501

Replicate	Study Day	Total Corrected Handwash (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficient (cm²/hr)	
	Gre	eens Mowing – 1 Day	After Appl	ication		
Av	erage	319			182	
Standard	l Deviation	81.1			157	
Geome	tric Mean	312			125	
	Gre	ens Mowing – 2 Days	After Appl	lication		
Av	erage	124			350	
Standard	l Deviation	85.2			355	
Geome	tric Mean	96.9			144	
	Gre	ens Mowing – Re-ent	ry Days Co	mbined		
Av	Average 222		266			
Standard	tandard Deviation 130		269			
Geometric Mean		174	174			
		Greens Watering (G	reens Activi	ity)		
GW1	1	660	0.232	3.02	944	
GW2	l	649	0.232	2.83	358	
GW3	2	49.2	0.439	3.12	35.9	
GW4	2	135	0.439	3.00	103	
GW5	3	558	0.132	2.32	1,821	
GW6	3	308	0.206	2.28	655	
GW7	4	383	0.014	2.23	11,856	
GW8	4	168	0.018	2.10	4,468	
	Gre	ens Watering – 1 Day	After App	lication		
Av	erage	435			945	
Standard	l Deviation	175			631	
Geome	tric Mean	406			797	
	Gre	ens Watering – 2 Day	s After App	lication		
Av	erage	184			4,116	

Replicate	Study Day	Total Corrected Handwash (µg)	TTR (µg/cm²) Time Worked (hours)		Transfer Coefficient (cm²/hr)	
Standar	d Deviation	142			5,561	
Geom	etric Mean	144			665	
	Gree	ns Watering – Re-en	itry Days Co	mbined		
A	verage	323			2,530	
Standar	d Deviation	201			4,037	
Geom	etric Mean	256			728	
]	Fairway Mowing (Fa	irway Activ	ity)		
FM1	1	367	1.46	2.22	113	
FM2	1	167	1.04	4.00	40.0	
FM3	2	42.3	0.903	3.60	13.0	
FM4	2	295	1.26	2.02	116	
FM5	3	2,236	0.895	4.47	559	
FM6	3	1,189	1.09	2.60	419	
FM7	4	427	0.084	3.97	1,284	
FM8	4	327	0.110	2.27	1,313	
	Fair	way Mowing – 1 Da	y After Appl	lication		
A	verage	990			283	
Standar	d Deviation	941			247	
Geom	etric Mean	635			181	
	Fair	way Mowing – 2 Day	s After App	lication		
A	verage	273			682	
Standar	d Deviation	164			714	
Geom	etric Mean	204	204		225	
	Fair	way Mowing – Re-en	itry Days Co	mbined		
A	verage	631			482	
Standar	d Deviation	733			538	
Geom	etric Mean	360			201	

Replicate	Study Day	Total Corrected Handwash (µg)	TTR (µg/cm²)	Time Worked (hours)	Transfer Coefficient (cm²/hr)
IR I	1	482	0.642	2.68	280
IR2	1	17.5	0.182	3.40	28.4
IR3	2	42.3	0.989	2.98	14.4
IR4	2	274	0.252	3.03	359
IR5	3	424	0.983	3.62	119
IR6	3	384	0.218	3.08	571
IR7	4	147	0.042	3.65	961
IR8	4	145	0.021	3.22	2,198
	Irrig	ation Repair – 1 Day	After App	lication	_
Average 327					250
Standard	Deviation	210			238
Geometric Mean		193			153
	Irriga	ation Repair – 2 Day	s After App	lication	
Ave	rage	152		883	
Standard	Deviation	95			960
Geomet	ric Mean	125			323
	Irriga	ation Repair – Re-en	try Days Co	mbined	
Ave	erage	240			566
Standard	Deviation	178			731
Geomet	ric Mean	155			222
	Misc	ellaneous Grooming	(Fairway A	ctivity)	
MGI	1	193	0.182	3.48	305
MG2	G2 2 87.6 0.826		2.72	39.1	
MG3	2	171	0.259	3.32	199
MG4	3	209	1.07	3.22	60.8
MG5	3	672	0.136	2.77	1,790
MG6	4	241	0.069	3.12	1,116

Table 8	. Transfer Coe	fficients for Hand Wa	ishes (Green	s and Fairv	vay Activities)
Replicate	Study Day	Total Corrected Handwash (µg)	Transfer Coefficient (cm²/hr)		
Av	erage	358		<u> </u>	718
Standard	Deviation	272			936
Geome	tric Mean	300	_		321
	Miscella	neous Grooming – 2	Days After A	Application	
Av	етаде	167			451
Standard	Deviation	77			581
Geome	tric Mean	153]		205
	Miscella	neous Grooming – R	e-entry Days	Combined	
Av	erage	262			585
Standard Deviation		207			712
Geometric Mean		215	1		257
	ŀ	All Maintenance Activ	vities Combi	ned	
	A	ll Activities – 1 Day A	After Applica	ation	
Av	erage	466			424
Standard	Deviation	453			508
Geome	tric Mean	336			215
	A	l Activities – 2 Days	After Applic	ation	
Av	erage	179			1,350
Standard	Deviation	110]		2,589
Geometric Mean		144			301
	Al	l Activities – Re-entr	y Days Com	bined	
Αv	erage	326			887
Standard	l Deviation	359			1,902
Geome	tric Mean	222			254

- The LOQ for hand wash is 1 μg . Residue values < LOQ were treated as ½ LOQ (0.500 μg).
- Corrected residue data represents corrected raw residue using the closest field fortification level recoveries for each corresponding reentry day.
- CC cup changing; GM greens mowing; GW greens watering; FM fairway mowing; IR irrigation repair; MG miscellaneous grooming
- Study Day I = Reentry 1 Day After Single Application on First Half of Course (Trial #1) Study Day 2 = Reentry 2 Days After Single Application on First Half of Course (Trial #1)

 - Study Day 3 = Reentry i Day After Single Application on Second Half of Course (Trial #2)

Study Day 4 = Reentry 2 Days After Single Application on Second Half of Course (Trial #2)

					Transfer	Coefficients	(cm ² /hr)		
Replicate	Application #	· -	Total Inner Dosimeter	Total Face/Neck	Total Hand Wash	Total Dermal Exposure	Arithmetic Mean Total Dermal Exposure	Std. Dev.	Geometric Mean Total Dermal Exposure
			Cuj	p Changing (Greens Activi	ity)		<u> </u>	
CC1	1	l	423	0.111	93.4	517			
CC2	1	1	78.1	0.107	26.7	105	356	220	289
CC4	2	1	18.9	1.68	426	447			
CC3	1	2	43.8	0.137	39.2	83.1			
CC5	2	2	212.4	4.61	1,887	2,104	2,266	2,268	931
CC6	2	2	2,304	6.72	2,301	4,611			
	Tota	al Cup Chan	ging (combine	d Re-entry da	ys)		1,311	1,781	519
			Gree	ens Mowing	(Greens Activ	ity)			
GM1	1	1	20.4	0.115	68.1	88.6			
GM2	1	1	9.91	0.084	38.8	48.8	1,138	1,808	314
GM5	2	1	338	2.43	249	589	1,136	1,000	314
GM6	2_	1	3,451	0.924	372	3,824	1		
GM3	1_	2	30.4	0.167	9.91	40.5	557	652	258
GM4	1	2	12.6	0.619	111	124			
GM7	2	2	684	2.45	777	1,463	7		

					Transfer	Coefficients	(cm ² /hr)		
Replicate	Application #	Reentry Day	Total Inner Dosimeter	Total Face/Neck	Total Hand Wash	Total Dermal Exposure	Arithmetic Mean Total Dermal Exposure	Std. Dev.	Geometric Mean Total Dermal Exposure
GM8	2	2	96.9	3.00	501	601			
	Tota	l Greens Mo	wing (combin	ed Re-entry d	ays)		847	1,296	285
			Gree	ens Watering	(Greens Acti	vity)			
GW1	I	1	506	0.715	944	1,450			
GW2	1	1	445	0.761	358	804	1 400	896	1.222
GW5	2	1	834	5.82	1,821	2,661	1,408	690	1,222
GW6	2	1	62.5	1.06	655	719			
GW3	1	2	146	0.861	35.9	183			
GW4	1	2	59.6	1.84	103	164	5,173	7,112	1,235
GW7	2	2	3,387	15.5	11,856	15,259	3,173	1,112	1,233
GW8	2	2	605	13.3	4,468	5,086			
	Total	Greens Wa	tering (combin	ed Re-entry d	ays)		3,291	5,106	1,228
			Fairv	vay Mowing	(Fairway Acti	ivity)			<u> </u>
FM1	1	1	54.8	0.448	113	169		<u> </u>	
FM2	1	1	919	0.371	40.0	959	674	421	527
FM5	2	1	536	1.37	559	1,096	674	431	537
FM6	2	1	51.0	0.545	419	471]		

					Transfer	Coefficients	(cm ² /hr)		
Replicate	Application #	Reentry Day	Total Inner Dosimeter	Total Face/Neck	Total Hand Wash	Total Dermal Exposure	Arithmetic Mean Total Dermal Exposure	Std. Dev.	Geometric Mean Total Dermal Exposure
FM3	1	2	227	1.00	13.0	241			
FM4	1	2	24.1	0.933	116	141	000	843	546
FM7	2	2	525	4.63	1,284	1,814	908	843	546
FM8	2	2	122	2.01	1,313	1,437			
	Total	Fairway Mo	owing (combin	ed Re-entry d	ays)		791	633	542
			Irriga	tion Repair	(Fairway Act	ivity)			
IR I	1	1	844	0.290	280	1,124			
IR2	1	1	686	0.809	28.4	715	1,075	293	1,043
IR5	2	1	1,308	0.357	119	1,427	1,073	293	1,043
IR6	2	1	461	0.744	571	1,033			
IR3	1	2	291	0.815	14.4	307			
IR4	1	2	1,368	2.73	359	1,730	10.004	37,285	2.006
IR7	2	2	1,065	3.28	961	2,030	19,994	31,403	3,006
IR8	2	2	73,705	7.56	2,198	75,910			
	Total	Irrigation R	epair (combin	ed Re-entry d	ays)		10,534	26,421	1,771
			Miscellan	eous Groom	ing (Fairway	Activity)	<u> </u>		
MG1	1	1	17,398	0.789	305	17,704	6,720	9,579	1,583

140	le 9. Total Der	mai expose	Tansier (Joenne III.		Coefficients		ong Sieeve S	inires
Replicate	Application #	Reentry Day	Total Inner Dosimeter	Total Face/Neck	Total Hand Wash	Total Dermal Exposure	Arithmetic Mean Total Dermal Exposure	Std. Dev.	Geometric Mean Total Dermal Exposure
MG4	2	1	34.0	0.145	60.8	94.9			
MG5	2	1	568	5.05	1,790	2,362			
MG2	1	2	309	0.223	39.1	348			
MG3	1	2	367	4.25	199	570	999	942	745
MG6	2	2	948	15.4	1,116	2,080			
	Total Mis	scellaneous (Grooming (cor	nbined Re-en	try days)		3,860	6,847	1,086
			All M	aintenance A	ctivities Com	bined			
		1 Da	y After Applic	ation			1,746	3,684	680
		2 Day	ys After Applic	cation		•	5,288	16,112	845
		Com	bined Re-entry	days			3,517	11,688	758

Footnotes: Total Dermal Exposure = sum of the inner dosimeter residues, face/neck wipe residues, and hand wash residues

	Table I	v. Potal De	ermal Exposur	e Fransier Co			s Wearing L cients (cm²/h		<u>a 1-snirt</u>	<u> </u>
Replicate	App#	Reentry Day	Outer Shirt (lower arm)	Total Inner Dosimeter	Total Face/ Neck	Total Hand Wash	Total Dermal Exposure	Arithmetic Mean Total Dermal Exposure	Std. Dev.	Geometric Mean Total Dermal Exposure
	- A		<u> </u>	Cu	ıp Changin	5		I		
CCI	1	1	0.862	423	0.111	93.4	518			
CC2	i	1	258	78.1	0.107	26.7	363	450	79	445
CC4	2	1	21.5	18.9	1.68	426	468			
CC3	1	2	60.7	43.8	0.137	39.2	144			
CC5	2	2	332	212	4.61	1887	2,437	3,740	4,395	1,447
CC6	2	2	4,028	2,304	6.72	2301	8,638			
		Total C	up Changing (c	ombined Re-er	ntry days)			2,095	3,313	802
				Gre	eens Mowin	g				
GM1	1	1	13.0	20.4	0.115	68.1	102			
GM2	1	1	24.8	9.91	0.084	38.8	73.7	1,274	1,847	409
GM5	2	i	354	338	2.43	249	943	1,4/4	1,047	403
GM6	2]	154	3451	0.924	372	3,978			
GM3	I	2	190	30.4	0.167	9.91	230	1,193	1,386	609

	}				Tran	sfer Coeffic	cients (cm²/h	r)		
Replicate	App#	Reentry Day	Outer Shirt (lower arm)	Total Inner Dosimeter	Total Face/ Neck	Total Hand Wash	Total Dermal Exposure	Arithmetic Mean Total Dermal Exposure	Std. Dev.	Geometric Mean Total Dermal Exposure
GM4	1	2	27.0	12.6	0.619	111	151		ļ	
GM7	2	2	1,664	684	2.45	777	3,128			
GM8	2	2	663	96.9	3.00	501	1,264			
		Total Gr	eens Mowing (combined Re-e	ntry days)			1,234	1,512	499
				Gre	ens Wateri	ng				
GW1	1	1	613	506	0.715	944	2,063			
GW2	1	1	529	445	0.761	358	1,333	2,093	1,258	1,850
GW5	2	1	1,216	834	5.82	1,821	3,877	2,093	1,236	1,050
GW6	2	1	380	62.5	1.06	655	1,099		ĺ	
GW3	1	2	494	146	0.861	35.9	676	,		
GW4	1	2	479	59.6	1.84	103	643	11,063	12,013	3,762
GW7	2	2	6,280	3,387	15.5	11,856	21,539	11,003	12,015	5,702
GW8	2	2	16,309	605	13.3	4,468	21,394]	ł	
	· · · · · · · · · · · · · · · · · · ·	Total Gre	eens Watering (combined Re-e	entry days)			6,578	9,247	2,638
				Fair	way Mowi	ng	····	L	· · · · · · · · · · · · · · · · · · ·	
FM1	1	1	34.1	54.8	0.448	113	203	1,648	1,680	991

· · · · · · · · · · · · · · · · · · ·	Table 1	0. Total De	ermal Exposui	e Transfer Co			···		d T-shirt	
			<u> </u>		Tra	isfer Coeffi	cients (cm²/h	r)	:	
Replicate	App#	Reentry Day	Outer Shirt (lower arm)	Total Inner Dosimeter	Total Face/ Neck	Total Hand Wash	Total Dermal Exposure	Arithmetic Mean Total Dermal Exposure	Std. Dev.	Geometric Mean Total Dermal Exposure
FM2	1	1	3,028	919	0.371	40.0	3,987]		
FM5	2	i	609	536	1.37	559	1,704			
FM6	2	1	229	51.0	0.545	419	699			
FM3	1	2	1,262	227	1.00	13.0	1,503			
FM4	1	2	75.3	24.1	0.933	116	216	2,413	2,495	1,395
FM7	2	2	4,176	525	4.63	1,284	5,990	2,413	2,473	1,595
FM8	2	2	504	122	2.01	1,313	1,942			
		Total Fair	rway Mowing (combined Re-	entry days)	_		2,031	2,011	1,175
				Irri	gation Rep	air	:			
IR I	1	1	387	844	0.290	280	1,512			
IR2	1	1	354	686	0.809	28.4	1,069	1,675	480	1,618
IR5	2	1	664	1308	0.357	119	2,092	1,075	700	1,010
IR6	2	1	995	461	0.744	571	2,027			
IR3	1	2	147	291	0.815	14	453	23,667	42,285	4,525
IR4	1	2	352	1368	2.727	359	2,082			
IR7	2	2	3,075	1,065	3.28	961	5,105			

					Tra	ınsfer Coeff	icients (cm²/h	ır)		
Replicate	App#	Reentry Day	Outer Shirt (lower arm)	Total Inner Dosimeter	Total Face/ Neck	Total Hand Wash	Total Dermal Exposure	Arithmetic Mean Total Dermal Exposure	Std. Dev.	Geometric Mean Total Dermal Exposure
IR8	2	2	11,118	73,705	7.56	2,198	87,028			
		Total Irrig	gation Repair (c	ombined Re-e	ntry days)			12,671	30,076	2,706
				Miscella	aneous Gr	ooming			· · -	
MG1	1	1	236	17,398	0.789	305	17,940			
MG4	2	1	104	34.0	0.145	60.8	199	6,932	9,612	2,116
MG5	2	l	296	568	5.05	1789.59	2,658			
MG2	1	2	38.5	309	0.223	39.1	387			
MG3	1	2	1328	367	4.25	199	1,897	2,079	1,790	1,426
MG6	2	2	1,873	948	15.4	1,116	3,952		i	
	Tot	al Miscella	neous Groomi	ng (combined I	Re-entry da	ıys)		4,505	6,731	1,737
				All Maintenar	ice Activit	ies Combin	ed			
		All A	ctivities – 1 Da	ıy After Applic	ation			2,223	3,723	1,027
		All A	ctivities – 2 Da	ys After Applic	cation			7,764	18,714	1,794
		Al Ac	tivities – Re-er	itry Days Com	bined			4,993	13,625	1,358

Footnotes: Total Dermal Exposure = sum of the inner dosimeter residues, outer dosimeter lower arms, face/neck wipe residues, and hand wash residues

Т	able 1	1. Total	Dermal Exp	osure Tra	nsfer Coeff	icients for V	Vorkers	Wearing S	Short Pants	and T-s	hirt
				- · · · · · · · · · · · · · · · · · · ·		Transfer Co	efficient	s (cm ² /hr)			
Replicate	App #	Reentry Day	Outer Shirt (lower arm)	Outer Pants (lower leg)	Total Inner Dosimeter	Total Face/Neck	Total Hand Wash	Total Dermal Exposure	Arithmetic Mean Total Dermal Exposure	Std. Dev.	Geometric Mean Total Dermal Exposure
			-		Cup (Changing					
CC1	1	1	0.862	735	424	0.111	93.4	1,253			
CC2	1	l	258	2,304	78.1	0.107	26.7	2,667	1,636	903	1,489
CC4	2	1	21.5	520	18.9	1.68	426	988			
CC3	1	2	60.7	954	43.8	0.137	39.2	1,097			
CC5	2	2	332	4,728	212	4.61	1,887	7,165	9,042	9,030	5,293
CC6	2	2	4,028	10,224	2,304	6.72	2,301	18,863	: ;		
		Tot	al Cup Chai	nging (com	bined Re-en	try days)		· · · · · · · · · · · · · · · · · · ·	5,339	7,028	2,807
					Green	s Mowing	····.				
GM1	1	1	13.0	559	20.4	0.115	68.1	661			
GM2	1	1	24.8	961	9.9	0.084	38.8	1,035	2,714	2,880	1,805
GM5	2	1	354	1,303	338	2.43	249	2,245	<i>2,11</i> 7	2,000	1,003
GM6	2	1	154	2935	3451	0.924	372	6,913			<u> </u>

Т	able 1	1. Total	Dermal Exp	osure Tra	nsfer Coeff	icients for V	Vorkers	Wearing !	Short Pants	and T-s	hirt
						Transfer Co	efficient	s (cm ² /hr)		.11.	
Replicate	App #	Reentry Day	Outer Shirt (lower arm)	Outer Pants (lower leg)	Total Inner Dosimeter	Total Face/Neck	Total Hand Wash	Total Dermal Exposure	Arithmetic Mean Total Dermal Exposure	Std. Dev.	Geometric Mean Total Dermal Exposure
GM3	1	2	190	1,751	30.4	0.167	9.91	1,982			
GM4	l	2	27.0	168	12.6	0.619	111	319	11,759	12,596	4,191
GM7	2	2	1,664	22,733	684	2.45	777	25,860	11,757	12,370	4,171
GM8	2	2	663	17,611	96.9	3.00	501	18,875			
		Tota	l Greens M	owing (con	nbined Re-en	ntry days)			7,236	9,743	2,750
					Greens	Watering					
GW1	1	1	613	1,925	506	0.715	944	3,988			
GW2	1	1	529	4,282	445	0.761	358	5,615	4,896	2,561	4,334
GW5	2	1	1,216	4,140	834	5.82	1,821	8,017	4,090	2,501	4,554
GW6	2	1	380	867	62.5	1.06	655	1,966		ĺ	
GW3	1	2	494	742	146	0.861	35.9	1,418			
GW4	1	2	479	4,463	59.6	1.84	103	5,106	51,305	 74,184	14,578
GW7	2	2	6,280	138,102	3,387	15.5	11,856	159,641	51,505	74,104	14,378
GW8	2	2	16,309	17,661	605	13.3	4,468	39,055			

						Transfer Co	efficient	s (cm²/hr)			
Replicate	App #	Reentry Day	Outer Shirt (lower arm)	Outer Pants (lower leg)	Total Inner Dosimeter	Total Face/Neck	Total Hand Wash	Total Dermal Exposure	Arithmetic Mean Total Dermal Exposure	Std. Dev.	Geometric Mean Total Dermal Exposure
	_	Tota	l Greens Wa	ntering (co	mbined Re-e	ntry days)			28,101	54,559	7,949
					Fairwa	y Mowing			****		
FM1	1	1	34.1	445	54.8	0.448	113	648			
FM2	1	1	3,028	2,629	919	0.371	40.0	6,616	2,877	2,596	2,089
FM5	2	1	609	169	536	1.37	559	1,874	2,077	2,370	2,009
FM6	2	1	229	1,669	51.0	0.545	419	2,369			
FM3	ı	2	1,262	1,448	227	1.00	13.0	2,951			
FM4	1	2	75.3	893	24.1	0.933	116	1,109	4,620	4,598	3,260
FM7	2	2	4,176	5,397	525	4.63	1,284	11,387	4,020	7,570	3,200
FM8	2	2	504	1,090	122	2.01	1,313	3,031	!		
		Total	Fairway M	owing (cor	nbined Re-e	ntry days)			3,748	3,580	2,609
					Irrigati	ion Repair	•	· · · · · · · · · · · · · · · · · · ·	· ***.		
IR1	1	1	387	5,708	844	0.290	280	7,220	5,688	2,140	5,327
IR2	1	1	354	6,431	686	0.809	28.4	7,500	·		

Т	able 1	1. Total I	Dermal Exp	osure Tra	nsfer Coeff	icients for V	Vorkers	Wearing S	Short Pants	and T-s	hirt
						Transfer Co	efficient	s (cm²/hr)			
Replicate	App #	Reentry Day	Outer Shirt (lower arm)	Outer Pants (lower leg)	Total Inner Dosimeter	Total Face/Neck	Total Hand Wash	Total Dermal Exposure	Arithmetic Mean Total Dermal Exposure	Std. Dev.	Geometric Mean Total Dermal Exposure
IR5	2	1	664	803	1308	0.357	119	2,894			
IR6	2	1	995	3112	461	0.744	571	5,139			
IR3	1	2	147	820	291	0.815	14.4	1,273			
IR4	1	2	352	7536	1368	2.73	359	9,618	42,564	49,452	16,076
IR7	2	2	3,075	44,658	1,065	3.28	961	49,763	} +2,304	77,432	10,070
IR8	2	2	11,118	22,575	73,705	7.56	2,198	109,603			
		Total	Irrigation l	Repair (con	nbined Re-e	ntry days)			24,126	37,928	9,254
					Miscellane	ous Groomi	ing			,,,,,,	
MG1	1	1	236	3,017	17,398	0.789	305	20,956			
MG4	2	1	104	863	34.0	0.145	60.8	1,061	9,777	10,174	5,459
MG5	2	1	296	4657	568	5.05	1790	7,315			
MG2	1	2	39	2103	309	0.223	39.1	2,490			
MG3	1	2	1328	1636	367	4.25	199	3,534	10,532	13,036	6,082
MG6	2	2	1,873	21,619	948	15.4	1,116	25,572			

						Transfer Coe	efficient	s (cm²/hr)			
Replicate	App #	Reentry Day	Outer Shirt (lower arm)	Outer Pants (lower leg)	Total Inner Dosimeter	Total Face/Neck	Total Hand Wash	Total Dermal Exposure	Arithmetic Mean Total Dermal Exposure	Std. Dev.	Geometric Mean Total Dermal Exposure
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		Total Mis	scellaneous	Grooming	(combined I	Re-entry days	s)		10,155	10,466	5,762
, .				All	Maintenanc	e Tasks Co	mbined				
			1 D	ay After Ap	plication				4,497	4,498	2,998
	-		2 Da	ys After A	pplication				22,714	39,358	6,966
			Con	bined Re-	entry days				13,606	29,177	4,569

Footnotes: Total Dermal Exposure = sum of the inner dosimeter residues, outer dosimeter lower arms & lower legs, face/neck wipe residues, and hand wash residues

	Table 12.	Total De	rmal Trans	sfer Coeffic	cient (cm	² /hr) Scena	rio Summ	ary		
	Long Pa	nts and Long	g Sleeves	Long	Pants and	Γ-shirt	Short Pants and T-shirt			
Re-entry Task	Arithmetic Mean	Std. Dev.	Geometric Mean	Arithmetic Mean	Std. Dev.	Geometric Mean	Arithmetic Mean	Std. Dev.	Geometric Mean	
			Co	mbined Re-ent	ry Days					
Cup Changing (n=6)	1,311	1,781	519	2,095	3,313	802	5,339	7,028	2,807	
Greens Mowing (n=8)	847	1,296	285	1,234	1,512	499	7,236	9,743	2,750	
Greens Watering (n=8)	3,291	5,106	1,228	6,578	9,247	2,638	28,101	54,559	7,949	
Fairways Mowing (n=8)	791	633	542	2,031	2,011	1,175	3,748	3,580	2,609	
Irrigation Repair (n=8)	10,534	26,421	1,771	12,671	30,076	2,706	24,126	37,928	9,254	
Miscellaneous Grooming (n=6)	3,860	6,847	1.086	4,505	6,731	1,737	10,155	10,466	5,762	
All Task Combined (n=44)	3,517	11,688	758	4,993	13,625	1,358	13,606	29,177	4,569	
			1 1	Day After Appl	ication					
Cup Changing (n=3)	356	220	289	450	79	445	1,636	903	1,489	
Greens Mowing (n=4)	1,138	1,808	314	1,274	1,847	409	2,714	2,880	1,805	
Greens Watering (n=4)	1,408	896	1,222	2,093	1,258	1,850	4,896	2,561	4,334	
Fairways Mowing (n=4)	674	431	537	1,648	1,680	991	2,877	2,596	2,089	
Irrigation Repair (n=4)	1,075	293	1,043	1,675	480	1,618	5,688	2,140	5,327	
Miscellaneous Grooming (n=3)	6,720	9,579	1,583	6,932	9.612	2,116	9,777	10,174	5,459	
All Task Combined (n=22)	1,746	3,684	680	2,223	3,723	1,027	4,497	4,498	2,998	

	Table 12. '	Total De	rmal Trans	sfer Coeffi	cient (cm	1 ² /hr) Scena	ario Summ	ary	
	Long Pa	nts and Lon	g Sleeves	Long	Pants and	l-shirt	Short	Pants and	Γ-shirt
Re-entry Task	Arithmetic Mean	Std. Dev.	Geometric Mean	Arithmetic Mean	Std. Dev.	Geometric Mean	Arithmetic Mean	Std. Dev.	Geometric Mean
			2 I	ays After App	lication				
Cup Changing (n=3)	2,266	2,268	931	3,740	4,395	1,447	9,042	9,030	5,293
Greens Mowing (n=4)	557	652	258	1,193	1,386	609	11,759	12,596	4,191
Greens Watering (n=4)	5,173	7,112	1,235	11,063	12.013	3,762	51,305	74,184	14,578
Fairways Mowing (n=4)	908	843	546	2,413	2,495	1,395	4,620	4,598	3,260
Irrigation Repair (n=4)	19,994	37,285	3,006	23,667	42,285	4,525	42,564	49,452	16,076
Miscellaneous Grooming (n=3)	999	942	745	2,079	1,790	1,426	10,532	13,036	6,082
All Task Combined (n=22)	5,288	16,112	845	7,764	18,714	1,794	22,714	39,358	6,966

		1	Table 13. R	espiratory Ex		/hour) Bas ir Sampli		due Level	s Found on		
Rep.	App#	Re-entry Day	Residue Value (µg)	Flow Rate (L/min)	Duration (min)	Sample Vol (L)	Air Cone. (μg/L)	Air Cone. (μg/ιn³)	NAFTA Ventilation Rate (m³/min)	Inhalation Exposure (µg/hr)	Arithmetic Mean Inhalation Exposure (µg/hr)
						Cup Chang	er				
CCI	1	1	0.005	1.95	96	187	2.67E-05	0.027	0.0167	0.027	
CC2	1	1	0.095	1.95	132	257	3.69E-04	0.369	0.0167	0.369	0.140
CC4	2	. 1	0.005	2.00	109	218	2.29E-05	0.023	0.0167	0.023	
CC3	1	2	0.005	1.95	161	314	1.59E-05	0.016	0.0167	0.016	
CC5	2	2	0.005	1.95	100	195	2.56E-05	0.026	0.0167	0.026	0.025
CC6	2	2	0.005	2.00	76	152	9.20E-05	0.033	0.0167	0.033	
Total Cu	p Changir	ig (combined	Re-entry days)							0.082
						Greens Mow	ing				
GM1	l	<u> </u>	0.005	1.90	160	304	1.64E-05	0.016	0.0167	0.016	
GM2	1	1	0.005	1.90	234	445	1.12E-05	0.011	0.0167	0.011	0.015
GM5	2	1	0.005	1.95	162	316	1.58E-05	0.016	0.0167	0.016]
GM6	2	1	0.005	1.95	154	300	1.67E-05	0.017	0.0167	0.017	
GM3	1	2	0.005	1.90	178	338	1.48E-05	0.015	0.0167	0.015	
GM4	Ī	2	0.005	1.95	133	259	1.93E-05	0.019	0.0167	0.019	0.017
GM7	2	2	0.005	1.95	172	335	1.49E-05	0.015	0.0167	0.015	0.017
GM8	2	2	0.005	1.95	132	257	1.94E-05	0.019	0.0167	0.019	
Total Greens Mowing (combined Re-entry days)									0.016		
						Greens Water	ing				
GWI	1	1	0.005	1.95	181	353	1.42E-05	0.014	0.0167	0.014	0.016

		······································	Table 13.	Respirator	ry Exposure (Based on Re		ls Found on		
Rep.	Арр#	Re-entry Day	Residue Value (µg)	Flow Ra		n Samp Vol (Air Conc. (μg/m³)	NAFTA Ventilation Rate (m³/min)	Inhalation Exposure (µg/hr)	Arithmetic Mean Inhalation Exposure (µg/hr)
GW2	1	ı	0.005	2.00	170	340	1.47E-0	5 0.015	0.0167	0.015	
GW5	2	1	0.005	1.95	139	27	1.84E-0	5 0.018	0.0167	0.018	7
GW6	2	1	0.005	2.00	137	274	1.82E-0	5 0.018	0.0167	0.018	_
GW3	1	2	0.005	2.00	187	374	1.34E-0	5 0.013	0.0167	0.013	
GW4	1	2	0.005	2.00	180	360	1.39E-0	5 0.014	0.0167	0.014	0.017
GW7	2	2	0.005	1.90	134	255	1.96E-0	5 0.020	0.0167	0.020	0.017
GW8	2	2	0.005	2.00	126	252	1.98E-0	5 0.020	0.0167	0.020	7
Total Gr	Total Greens Watering (combined Re-entry days)										0.017
						Fairway	Mowing				
FM1	1	1	0.005	1.95	133	259	1.93E-0.	5 0.019	0.0167	0.019	
FM2	1	1	0.005	1.95	240	468	1.07E-0.	5 0.011	0.0167	0.011	0.014
FM5	2	ı	0.005	1.90	268	509	9.82E-0	6 0.010	0.0167	0.010	0.014
FM6	2	1	0.005	1.95	156	304	1.64E-0:	5 0.016	0.0167	0.016	
FM3	1	2	0.005	1.95	216	421	1.19E-0	5 0.012	0.0167	0.012	
FM4	1	2	0.005	1.95	121	236	2.12E-0	5 0.021	0.0167	0.021	0.016
FM7	2	2	0.005	1.95	238	464	1.08E-0	5 0.011	0.0167	0.011	0.010
FM8	2	2	0.005	1.95	136	265	1.89E-0:	5 0.019	0.0167	0.019	
Total Fairway Mowing (combined Re-entry days)										0.015	
						Irrigation	n Repair				
IR1	1	ı	0.025	1.90	161	306	8.04E-05	0.080	0.0167	0.081	0.051
IR2	ı	1	0.038	1.95	204	398	9.63E-05	0.096	0.0167	0.096	

	I T		l p t.	T	OV	S Air San	npling Tubes	<u> </u>	N. A. T. T. T. A.		
Rep.	App#	Re-entry Day	Residue Value (µg)	Flow Rate (L/min)	Duratio (min)			Air Conc. (µg/m³)	NAFTA Ventilation Rate (m³/min)	Inhalation Exposure (µg/hr)	Arithmetic Mean Inhalation Exposure (µg/hr)
IR5	2	1	0.005	1.95	217	423	1.18E-05	0.012	0.0167	0.012	
IR6	2	1	0.005	2.00	185	370	1.35E-05	0.014	0.0167	0.014	
IR3	1	_ 2	0.005	2.00	179	358	1.40E-05	0.014	0.0167	0.014	
IR4	1	2	0.005	1.95	182	355	1.41E-05	0.014	0.0167	0.014	0.013
IR7	2	2	0.005	1.90	219	416	1.20E-05	0.012	0.0167	0.012	0.015
IR8	2	2	0.005	2.00	193	386	1.30E-05	0.013	0.0167	0.013	
Total Irr	igation Re	pair (combi	ned Re-entry d	ays)							0.032
						Miscellaneou	ıs Grooming				
MG1	1	1	0.071	2.00	209	418	1.71E-04	0.171	0.0167	0.171	
MG4	2	ı	0.005	1.95	193	376	1.33E-05	0.013	0.0167	0.013	0.067
MG5	2	1	0.005	1.95	166	324	1.54E-05	0.015	0.0167	0.015	
MG2	ī	2	0.096	1.90	163	310	3.11E-04	0.311	0.0167	0.312	
MG3	1	2	0.005	2.00	199	398	1.26E-05	0.013	0.0167	0.013	0.113
MG6	2	2	0.005	1.95	187	365	1.37E-05	0.014	0.0167	0.014	
Fotal Mi	scellaneou	is Grooming	(combined Re	e-entry days)							0.090
					All N	Maintenance	Tasks Combined				
All Tasks – 1 Day After Application									0.046		
All Tasks – 2 Days After Application									0.030		
All Task	Il Tasks – Combined Re-entry Days									0.037	

- The LOQ for OVS tubes is 0.01 µg. Residue values < LOQ were treated as ½ LOQ (0.005 µg)

 None of the residue values required correction for field fortification recoveries.

 For Rep. FM5, the pump quit working before the end of the monitoring period. The total air sampled was estimated.

- CC cup changing; GM greens mowing; GW greens watering; FM fairway mowing; IR irrigation repair; MG miscellaneous grooming Concentration $(\mu g/m^3)$ = Residue (μg) [Flow rate (L/min) x Duration (min)] x 1000 (L/m³) Inhalation Exposure $(\mu g/hr)$ = Concentration $(\mu g/m^3)$ x Ventilation Rate (m^3/min) x 60 minutes

Table 14. Distribution of Residue on Body Parts for Total Dermal Exposure											
	Exposu	otal Der e 1 Day plication	After	Exposu	Total Der re 2 Days pplication	After	% of Total Dermal Exposure Combined Re-entry Days				
Body Part	Long Pant/Lo ng Sleeve Shirt	Long Pants/ T- shirt	Short s/ T- shirt	Long Pant/Lo ng Sleeve Shirt	Long Pants/ T-shirt	Shorts/ T-shirt	Long Pant/ Long Sleeve Shirt	Long Pants/ T-shirt	Shorts/ T-shirt		
Lower Arm	15	43	11	13	64	14	14	53	12		
Upper Arm	1.0	0.70	0.18	1.3	0.53	0.11	1.2	0.63	0.14		
Front Torso	1.6	1.1	0.29	1.7	0.71	0.15	1.7	0.92	0.21		
Rear Torso	1.2	0.79	0.21	1.4	0.60	0.13	1.3	0.71	0.16		
Lower Leg	19	13	77	13	5	80	16	9	79		
Upper Leg	4.1	2.7	0.72	7.7	3.2	0.7	5.7	3.1	0.70		
Face/ Neck	0.16	0.104	0.027	0.42	0.17	0.037	0.26	0.14	0.032		
Hands	58	38	10	61	25	5.4	60	32	7.4		
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0		



R125305

Chemical: Chlorothalonil

PC Code: 081901

HED File Code: 12000 Exposure Reviews

Memo Date: 3/6/2006 File ID: DPD327361 Accession #: 412-06-0193

HED Records Reference Center 7/18/2006